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# Spatial variations of chronic schizophrenia in Windsor, Ontario from January 1, 1978 to June 30, 1980.

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# SPATIAL VARIATIONS OF CHRONIC SCHIZOPHRENIA IN WINDSOR, ONTARIO FROM JANUARY 1, 1978 TO JUNE 30, 1980

by
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A Thesis
Submitted to the Faculty of Graduate Studies
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Dedicated to my parents

## ABSTRACT

This thesis concerned the geographic distribution of schizophrenia cases in the City of Windsor. It delineated the location and some attributes of areas, where schizophrenia case clustering occurs, based on data from St. Thomas Admission Records and 1976 census tapes with enumeration area data. Results indicated that the pattern of schizophrenia cases was clustered. Two important clusters were recognized, the major one just to the east of the CBD and a secondary one just to the southeast of this major cluster. Enumeration-area based Step-Wise Multiple Discriminant Analysis was Undertaken. The results indicated two of the six variables used as being good discriminators of the distribution of schizophrenia cases in Windsor. These two variables were Number of persons per household: 2-10 and Age: 15-44. Future research will have to concentrate on obtaining a better representative sample of those diagnosed schizophrenic in order to substantiate any understandings of the factors related to schizophrenia and its distribution.

ACKNOWLEDGEMENTS

I would like to thank many people who assisted in this study. First, I would like to thank Dr. Frank Innes, who obtained the data for this study from St. Thomas and who advised me throughout the research. Appreciation must also be given to Dr. P. D. LaValle, who gave a great deal of assistance and guidance in the statistical aspects of this study. Also Dr. G. R. Frisch must be thanked for his aid with respect to the model of schizophrenia used.

Besides the committee, who worked on this thesis other people aided when asked. Tim Ross aided by supplying material from the Map Library needed for this research. Ron Welch provided advise on cartographic work done for this thesis along with materials and encouragement. Graham Staffen supplied information from the computer tapes of the 1976 enumeration area levels for use in this study. The aid given by these people was much appreciated.

Finally, Belayet Khan and my parents must be thanked for their patience and encouragement throughout the development of this thesis. Belayet also offered assistance with the statistical aspects of this study.

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# CHAPTER I

## INTRODUCTION

Health is an important concept that pertains to all people. Health has been defined by the World Health Organization as a state of complete physical, social and mental well being, not merely the absence of disease and infirmity (Le Riche and Milner, 1971, p. 81). This definition tends to be a little unrealistic because very few people experience complete physical, social and mental well being simultaneously. Does this mean the majority of people suffer from ill-health? Therefore the World Health Organization's definition of health should be modified. On the other hand, ill-health is seen as a maladjustment of man to the environment: physical, cultural and social (May, 1974, p. 33). The field of Medical Geography was developed in order to better understand relationships between ill-health and the environment. Medical Geography involves the comparative study of the incidence of disease and the distribution of physiological traits in people belonging to different communities throughout the world, along with the correlation of these data with factors in the environment (Howe, 1972, p. 2).

Medical Geography has concentrated on studies of the spatial and climatic aspects of mortality rates, disease mapping and disease distribution and diffusion. An example of a study involving the spatial and climatic aspects of mortality is Field's (1978) study on the "Temporal Trends and Spatial Patterns of Mortality in Canada" found in the book Canadian Studies in

Medical Geography. Disease mapping studies are well illustrated by Christou's (1978) study on the Spatial Variations of Ischaemic Heart Disease Mortalities in Windsor, Ontario, 1967-1975. Finally, Sigworth's (1976) study on the "Spatial Structure of Disease Diffusion and Control: Foot and Mouth Disease in Mexico" is an excellent example of a diffusion study. This study is also found in the book Canadian Studies in Medical Geography.

The field of Medical Geography has a great number of such studies which have been completed. However, very little research in this field has been done with respect to mental disorders. Mental disorders are just as prevalent as physiological illnesses. Therefore research is also required into the spatial distributions and environmental factors related to these mental disorders.

Schizophrenia is the most devastating of the major mental disorders. More than half of the mental hospital beds in the United States are occupied by people suffering from some form of schizophrenia. Most of these sufferers are between the ages of fifteen and forty-five, which are supposedly the most productive years of one's life (Martin, 1970, p. 21). Therefore if research in Medical Geography is to consider mental disorders, schizophrenia should be of prime interest.

As a result, schizophrenia is the subject of this thesis. This study will first focus on determining the spatial distribution of schizophrenia in Windsor. After this distribution has been mapped an investigation will be undertaken to determine if any particular social, economic or cultural variables play

a role in producing the resulting distribution.

This study into the spatial distribution of schizophrenia and what variables contribute to it is very important and very necessary since Medical Geographical research into schizophrenia is non-existant. Also a knowledge of the variables that contribute to the resulting distribution may lead to a much better understanding of schizophrenia, along with its etiology. Therefore it is evident that this research is pertinent and will be useful for further research in this field.

## CHAPTER II

## REVIEW OF THE LITERATURE

Medical Geography has been interpreted as a narrow subfield of medicine or geography. It is a multidimensional body of knowledge and a multifaceted approach geared towards understanding spatial aspects of human health problems (Pyle, 1979, p.3).

It seems that the Greeks were the first to develop an understanding of the importance of geographical variations of health problems. Evidence of this comes from the various accounts of the geographical influences of disease written by the Greeks. They identified specific outbreaks of contagious diseases within cities and other locations.

During the nineteenth century August Hirsch developed a three-volume handbook of historical and geographical pathology. In the pre-World War II period Rodenwaldt and Jusatz produced a World Atlas of Epidemic Diseases. This was a monumental, three-volume work which is still utilized as a reference in terms of the environmental risk factors for many diseases.

In North America during the three decades after the second World War a wider variety of comprehensive studies in the field of Medical Geography were produced than had been accomplished for centuries before. At this time an interest into the prevalence of environmentally-induced non-infectious chronic diseases developed. A large number of books and articles were written concerning this new interest. Examples of such works were May (1958,1961), Sauer (1959,1962), McGlashan (1965,1969, 1972), Kahn (1971) and LeRiche

and Milner (1971). The above references shared a common theme, which was that disease may be regarded as a complex interaction of agent, host and environment. This theme lent itself well to geographical research since geography was and still is a discipline that focuses on the analysis of man-environment relationships.

The medical geographer's tasks were to prepare and collate disease data and to map them to show where a certain condition was prevalent or absent; to apply objective statistical tests to these distributions to assess whether or not the pattern was likely to have occurred by chance; to measure the degree of co-extensiveness between disease and other spatially varying factors; and then to apply tests to decide whether any spatial associations revealed could be causative (Christou, 1978, p. 8).

Literature pertaining to the study of the historical nature of diseases, their diffusion and endemic source areas was well illustrated by Howe's Man, Environment and Disease in Britain (1972) and Cartwright's Disease and History (1972).

The design and application of the tools and techniques of medical geographer's were found in Armstrong's Computers and Mapping in Medical Geography (1972) and Hagget's Hybidizing Alternative Models of an Epidemic Diffusion Process (1976).

There have been a number of research attempts into the types and spatial variations of infectious diseases. Examples of these were May's Studies in Disease Ecology (1958) and Hunter and Young's Diffusion of Influenza in England and Wales (1971).

Hunter and Brunn's The Geography of Psychosocial Stress (1974) was an excellent example of studies into psychosocial or stress related diseases such as alcoholism, drug addiction and various types of mental disorders.

Research has also been done with respect to aspects of spatial allocation and planning for health care facilities. Examples of such studies were Pyle's Heart Disease, Cancer and Stroke in Chicago (1971) and Shannon's Urban Ecological Containers, Environmental Risk Cells and the Use of Medical Services (1976).

The most common and important method used for studying regional differences for chronic diseases involved examining the observed mortality rates or some comparable quantity for consistent trends. Consistency might be sought between the sexes, or among different age groups, or between different time periods, or among adjacent geographical regions. Therefore if a region had abnormally high or low mortality rates for both sexes in a number of age groups consistently over a number of time periods and if it was one of a number of contiguous regions with high or low rates, then it was probable that the region had abnormal mortality. However, if the rates were high in some age groups of both sexes but low in others, and if there was no consistent trend over time, then it was likely that the abnormal rates represented random fluctuations (El-Shaarawi, et al., 1976, p. 312). One example of a large compilation of regional mortality data was Howe's A National

Atlas of Disease Mortality in the United Kingdom (1970). He used standardized mortality rates to produce choropleth maps, which illustrated the distributions of selected mortalities from diseases in the United Kingdom.

Schizophrenia can be considered the most serious of the mental disorders since so many people are in mental hospitals because of it. Schizophrenia is a group of disorders which are marked by severe distortion and disorganization of thought, perception and affect. It is also accompanied by bizzare behaviour and social withdrawal. The subtypes of schizophrenia are disorganized, catatonic, paranoid, undifferentiated and residual. Each has some of its own unique symptoms and each has a different age of onset, along with different progression times. Disorganized schizophrenia is marked by fragmented delusions and hallucinations. Catatonic schizophrenia is characterized by psychomotor disturbances such as rigidity, posturing and stupor. A paranoid schizophrenic is preoccupied with persecutory or gandiose delusions. Undifferentiated schizophrenia is the category for persons whose symptoms cannot be classified in any of the other subtypes. Finally, a residual schizophrenic is an individual currently displaying no prominent symptoms but who at one time displayed episodes of bizarre psychotic behaviour (Mears and Gatchel, 1979).

Disorders, resembling what is now called schizophrenia, have been described throughout history by all cultures. Since the seventeenth century the medical and social implications of

this disturbance have been increasingly understood. Willis (1647) made one of the first scientific contributions to the study of schizophrenia by describing certain brilliant youths who passed into obtuseness and hebetude during adolesence (Dunham, 1965, p.40). Another researcher, Morel, first used the term "dementia praecox" during the 1850's to describe a form of degeneracy in which he attempted to describe a unity of cause, course and outcome. Hecker (1870) described hebephrenia as a disorder related to puberty and adolesence, which led to deterioration. Kahlbaum (1868) described catatonia and Ellinger (1845) developed the paranoic concept.

Kraepelin (1898) synthesized the various concepts of hebephrenia, catatonia, paranoia and deterioration and described dementia praecox as a chronic illness which ordinarily began in adolesence. Bleuler (1911) used the term schizophrenia when describing this illness because he emphasized the splitting of different pyschic functionings as one of the most significant characteristics of the illness. Bleuler broadened the concept of schizophrenia because he did not believe a unified concept of disease was applicable to its interpretation. Meyer emphasized that schizophrenia was a type of faulty reaction involving a multiplicity of biological factors and stressful life experiences, which led to the disruption of judgement, discrepancies of mood and thinking interferences (Dunham, 1965, p. 41). Therefore it was evident that there was a possibility of a multiplicity of factors playing a role in the development of schizophrenia. This led to an interdisciplinary viewpoint of research concerning

schizophrenia. Research about schizophrenia has been done in biochemistry, physiology, psychology, sociology and anthropology.

Research has indicated that patients who developed schizophrenia were more likely to have an increased sensitivity to stress, particularly of interpersonal nature. Symptoms of this disorder such as withdrawal, seclusiveness and paranoid mechanisms were defenses against these interpersonal and intrapersonal stresses (Dunham, 1965, p. 43).

A good deal of research has been done dealing with the etiology of schizophrenia. Hollingshead and Redleich emphasized that the "social environmnet in which individuals live is connected in some way, as yet not fully explained, to the development of schizophrenia" (Rose, 1955, p. 123). Results of previous studies seemed to indicate that there might be some relationship between type of mental disorder and the individual's occupation. Income and prestige were found to be closely related to one's socio-economic status and therefore occupation might be suggested as an index of socio-economic status (Rose, 1955, p. 136). Therefore what was true for a person of a given occupation might also be true for a person of a given socio-economic status. Rose (1955) found that an inverse relationship existed between the prevalence of mental disorders and socio-economic status. He also found that unemployment was significantly correlated to the prevalence of mental disorders for both men and women.

Age had such a great influence on rates of mental illness ~~that~~ that it needed to be controlled in order to relate other variables such as sex, marital status, social class, occupation, education,

income, residence, religion and household and family variables to the mental disorder rates. Dunham (1965) in a Detroit study found that the prevalence of schizophrenia seemed to be lower among married persons. Morgan and Andrushko (1977) indicated that the less-educated one was, the more likely one was to develop schizophrenia under the right circumstances. Faris and Dunham (1967) found a significant negative correlation between median school grade reached and rates of schizophrenia. Another variable which seemed to have an effect on the rates of mental disorders was the number of persons per household. Parker et al. (1969) found that the prevalence of schizophrenia seemed to be greater for single person households. Mobility has been found to affect the rates of schizophrenia. Faris and Dunham (1967) found that high schizophrenic rates tended to be more prevalent in communities where the populations were highly mobile. Home ownership was used as the index of stability or mobility because home ownership inhibited moving.

A review of the literature on immigration and mental disorders left one puzzled. Confusion resulted from the fact that the results of these studies did not have consistent findings from one area to another. In Canada, Murphy (1969) indicated that the foreign-born had lower mental hospitalization rates than those for the native-born. Similar results have been found by Krupinskie et al. (1965) in a large survey of the state of Victoria in Australia. Other researchers such as Malzberg (1960's), in the United States found that the foreign-born possed higher admission rates to mental hospitals compared to the native-born.

One might expect that the foreign-born would have higher rates of mental disorders because of the stresses associated with immigration and acculturation. Malzberg also did a series of studies in Canada in the early 1960's. Again he related mental disorders to immigration. He found that the rates of mental disorders for those of British ethnic origin tended to be greater than for those of French ethnic origin. Malzberg also found that American-born persons tended to have a low rate of schizophrenia in Canada, which was probably because of their close cultural ties to Canada. Finally, religious affiliation was studied and it was found that schizophrenia tended to be more prevalent among those of the Jewish faith in Canada.

The distribution pattern of schizophrenia has been studied in various areas. Faris and Dunham (1967) did a study in Chicago, Dunham (1965) studied Detroit and other researchers studied Providence, Rhode Island. They all found that the highest rates of schizophrenia were concentrated in the central section of the city. Rates of schizophrenia decreased as one moved to the periphery of the city. These distribution patterns may also be related to the socio-economic conditions of these areas. At the time of these studies the CBD was usually an area of relatively low socio-economic status. Choropleth maps were used to indicate the resulting pattern.

The studies on mental disorders and schizophrenia mentioned were not undertaken in the discipline of Medical Geography. As a result, they lacked an emphasis on location and pattern, which

are two important components for any geographical study.

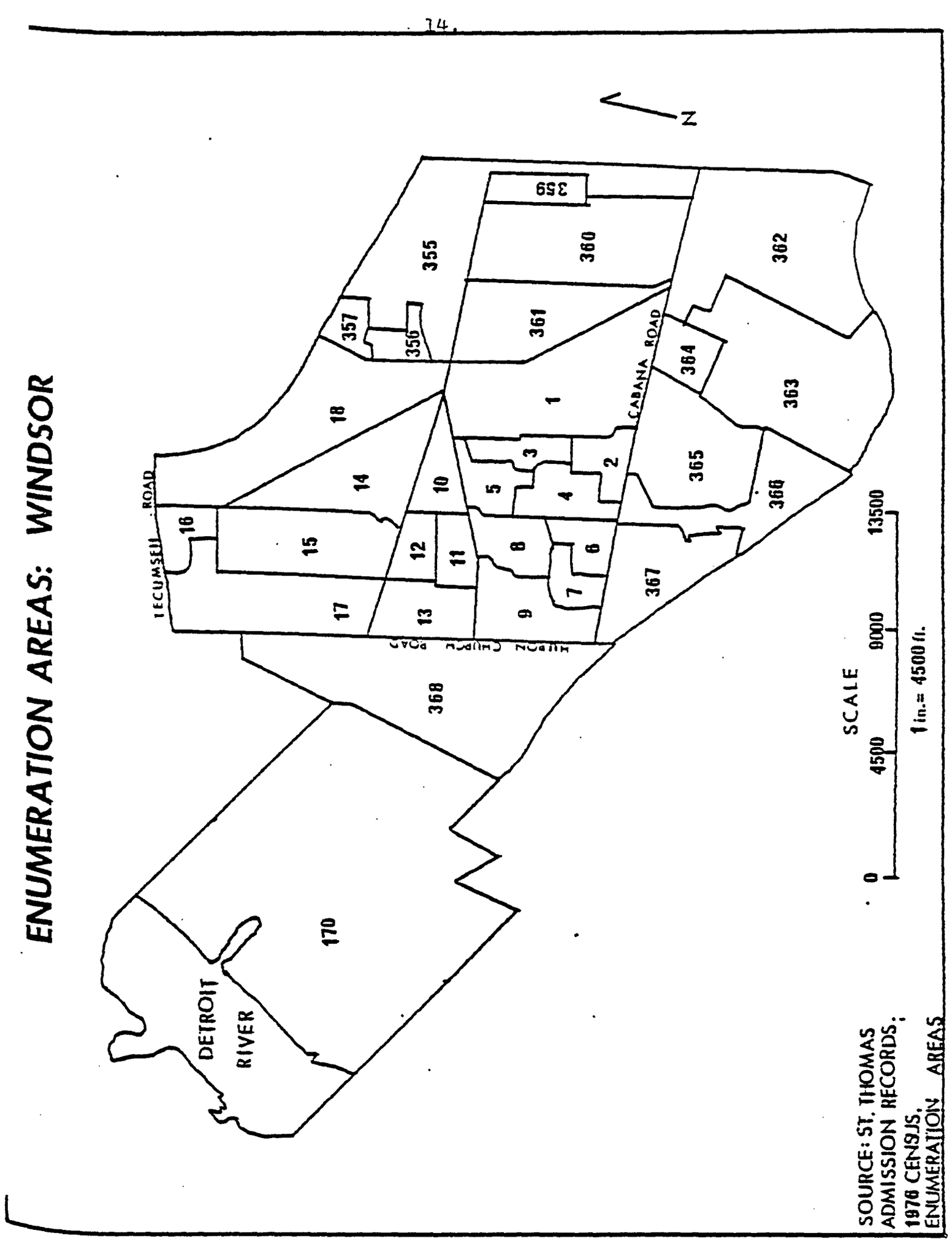
# CHAPTER III

## STUDY AREA

The study area for this investigation is Windsor, Ontario. Windsor happens to be located in relatively close proximity to St. Thomas. St. Thomas is a provincial mental hospital, which admits the most severe cases of mental disorders from the surrounding region of Southern Ontario. Data has been made available by St. Thomas for the Windsor area for use in this research.

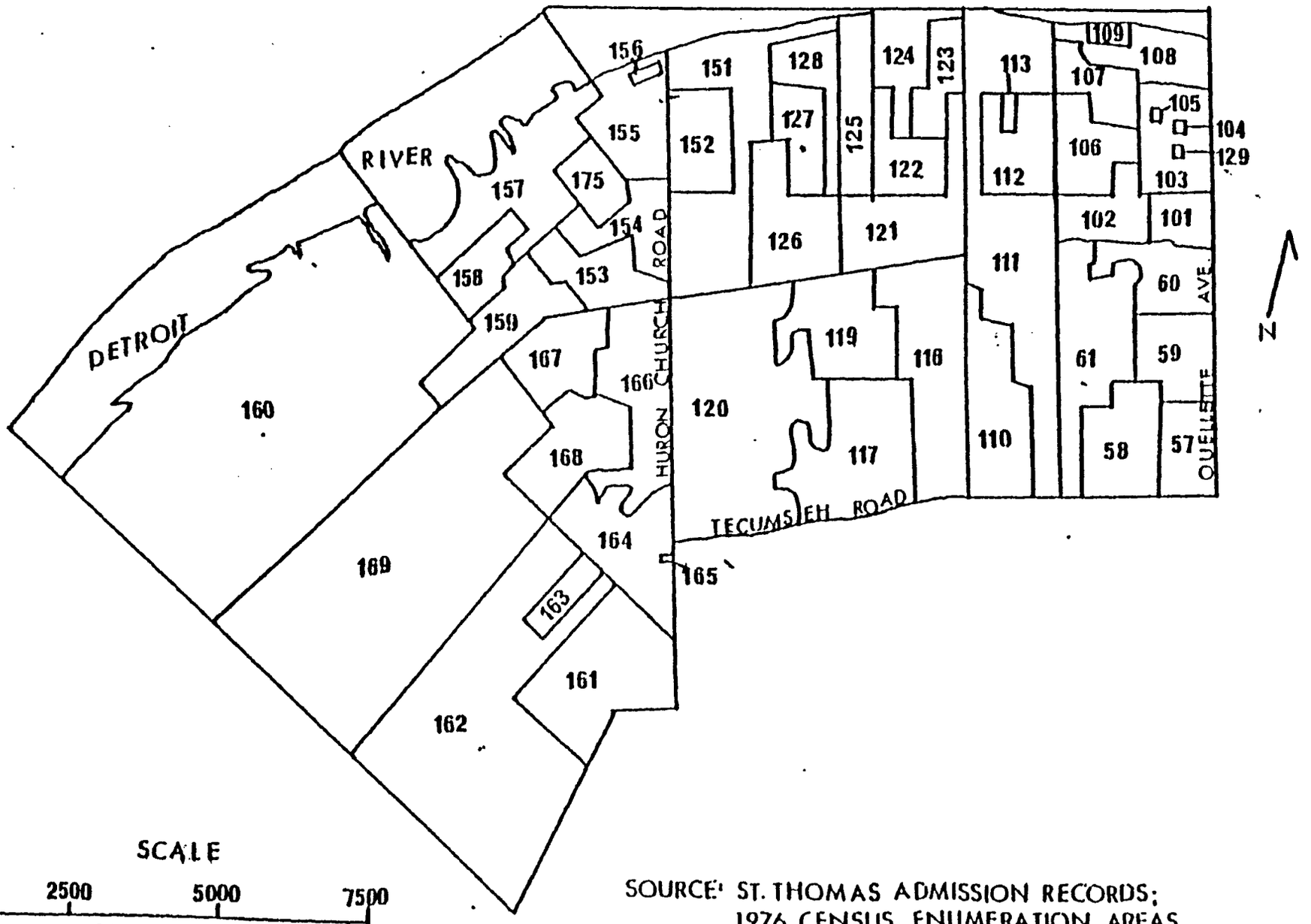
Windsor, with a population of approximately 200,000 people is considered a medium sized city. Since research has already been done in the United States for large cities in terms of the distribution of mental disorders, it may be interesting to do a study on a medium sized city to add to any Canadian research that has been done in this area.

This study will be done on the basis of enumeration areas. A base map of Windsor's enumeration areas will be used in the study (Figure 1). There are 210 enumeration areas found in Windsor. On the average, each enumeration area has a population of about 1000 with some enumeration areas having populations as little as 300 people and some areas have populations of about 2000 people. Windsor is divided into three Federal Enumeration Districts which are subsequently divided into the 210 enumeration areas. The three Federal Enumeration Districts are Essex-Windsor, Windsor-Walkerville and Windsor West. One must be careful when dealing with the enumeration areas because more than one enumeration area may have the same number. For example, enumeration area




- FIGURE 1-MAP 1

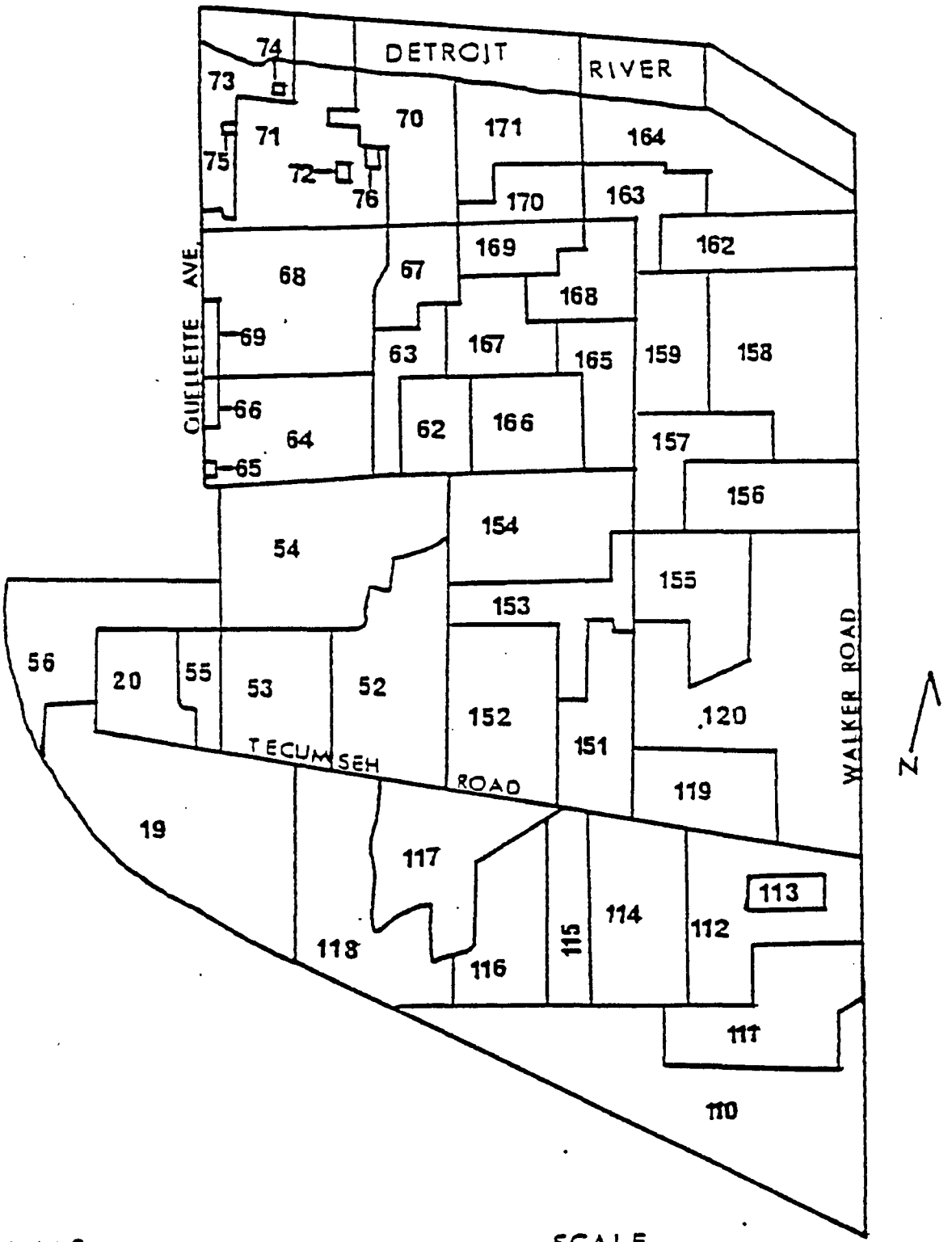
# ENUMERATION AREAS: WINDSOR




SOURCE: ST. THOMAS ADMISSION RECORDS; 1976 CENSUS, ENUMERATION AREAS

FIGURE 1-MAP 2

# ENUMERATION AREAS: WINDSOR




SOURCE: ST. THOMAS ADMISSION RECORDS: 1976 CENSUS, ENUMERATION AREAS

FIGURE 1-MAP 3

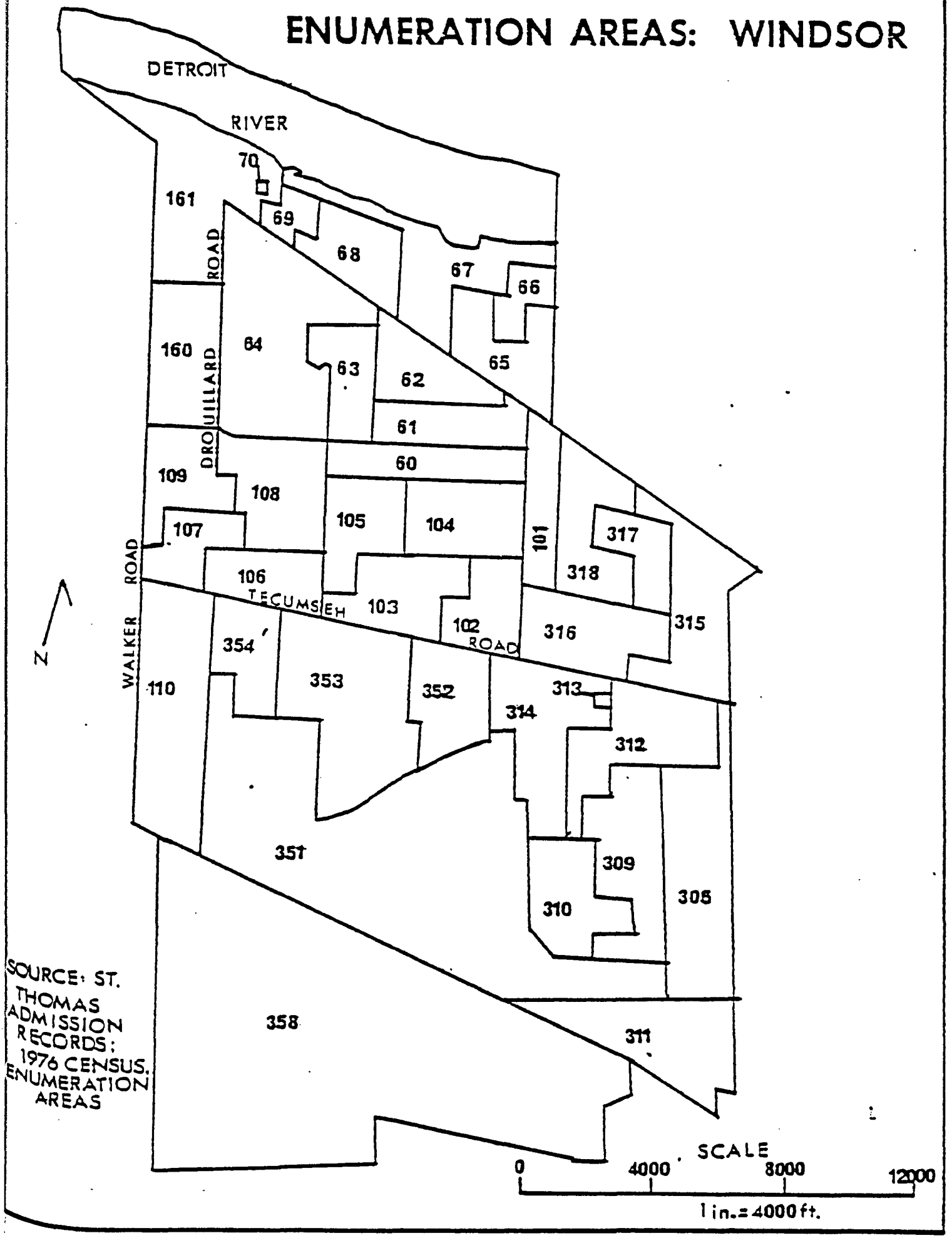
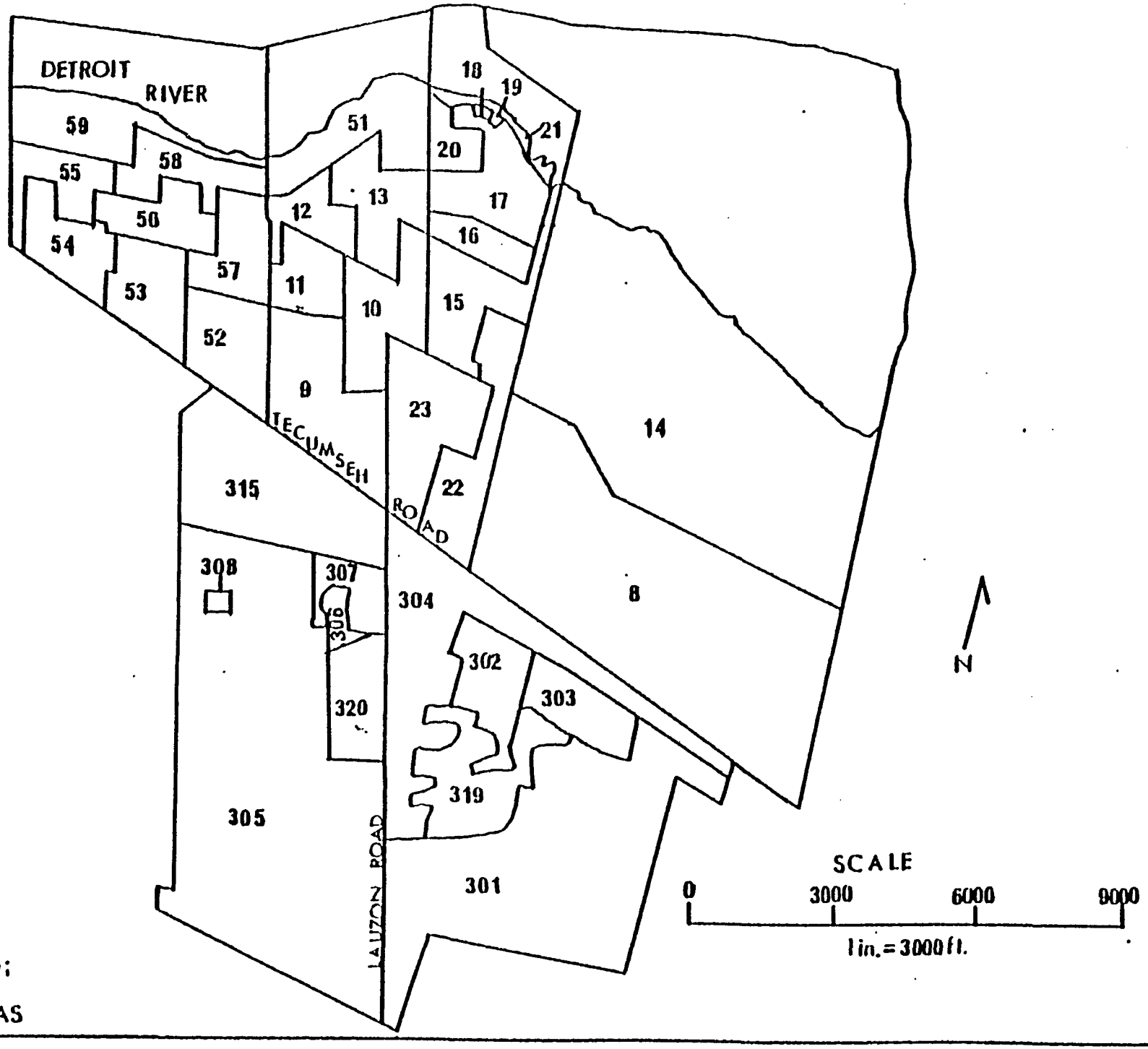



FIGURE 1-MAP 4

# ENUMERATION AREAS: WINDSOR




SOURCE: ST. THOMAS ADMISSION RECORDS; 1976 CENSUS, ENUMERATION AREAS

FIGURE 1-MAP 5

number eight is found in Windsor-Walkerville while another enumeration area number eight is found in Windsor West. This situation pertains to a few of the other enumeration areas as well.

These enumeration areas are smaller than the census tracts found in Windsor. As a result, they should permit more realistic relationships to surface between the schizophrenia pattern and variables such as age, size of household, occupation, mobility and education level.

In the field of Medical Geography, research is required with respect to mental disorders. Such research would be useful in all parts of the country but since the data is available for Windsor this study will deal with schizophrenia cases found in Windsor.

# CHAPTER IV

## SCHIZOPHRENIA MODEL

The basic goal of this investigation will be to attempt to develop a model relating the incidence of schizophrenia to those social, cultural and economic phenomena that are supposed to have an influence on the development of schizophrenia. A model is a formal representation of the researcher's image of the real world, which portrays those relationships that are of greatest interest to the investigator. In this study variables in the social, cultural and economic environments, which are in some way related to stress, will be looked at in terms of their impact on the incidence of schizophrenia.

Stress ia an important mechanism in the development of schizophrenia. A normal individual will have a normal arousal response to stress but the preschizophrenic has a heightened sensitivity to stress. As a result, this person shows a much greater response to any stress and they recover from the stress at a slower rate. If the individual can get away from the troublesome situation the anxiety will subside. However, one cannot remove oneself completely from society.

Certain consequences ensue from consistent exposure to stress. First, one will experience an increase in generalization, which will cause many new stimuli to become potential anxiety arousers. Generalization refers to the process by which an organism, conditioned to respond in a certain way to a particular stimulus, will also respond to similar stimuli in the same way (Calhoun, 1977).

Also stimuli, which previously elicited anxiety reactions, will elicit stronger anxiety reactions. As a result, the probability of encountering an anxiety-arousing stimulus is increased. This cycle will continue and the anxiety will increase (Mednick, 1974, pp. 42-43). Figure 2 illustrates the differences in arousal and recovery time between a normal person and a preschizophrenic. In order to cope with the stresses one will develop defenses against them. These defenses manifest themselves in the form of withdrawal, seclusiveness and paranoid mechanisms, which are characteristic symptoms of schizophrenia.

Dunham (1965) indicates that it has been frequently hypothesized that stresses in the social environment are more prevalent at lower socio-economic levels. Since income and prestige are closely related to one's socio-economic status one may suggest occupation as an index of socio-economic status (Rose, 1955, p. 136). Therefore one is able to see that stresses at lower socio-economic levels may be related to occupation and income. Hollingshead and Redleich (1958) also mentioned that lower socio-economic levels are characterized by lower levels of education. As a result, level of education may also have a role in this prevalence of stress at lower socio-economic levels.

Stress may also result from seclusiveness or loneliness, which characterize schizophrenia. Married people have an important unity, which may protect them from developing stresses. The number of people per household is important. People who live alone may experience a great deal of anxiety as a result of their

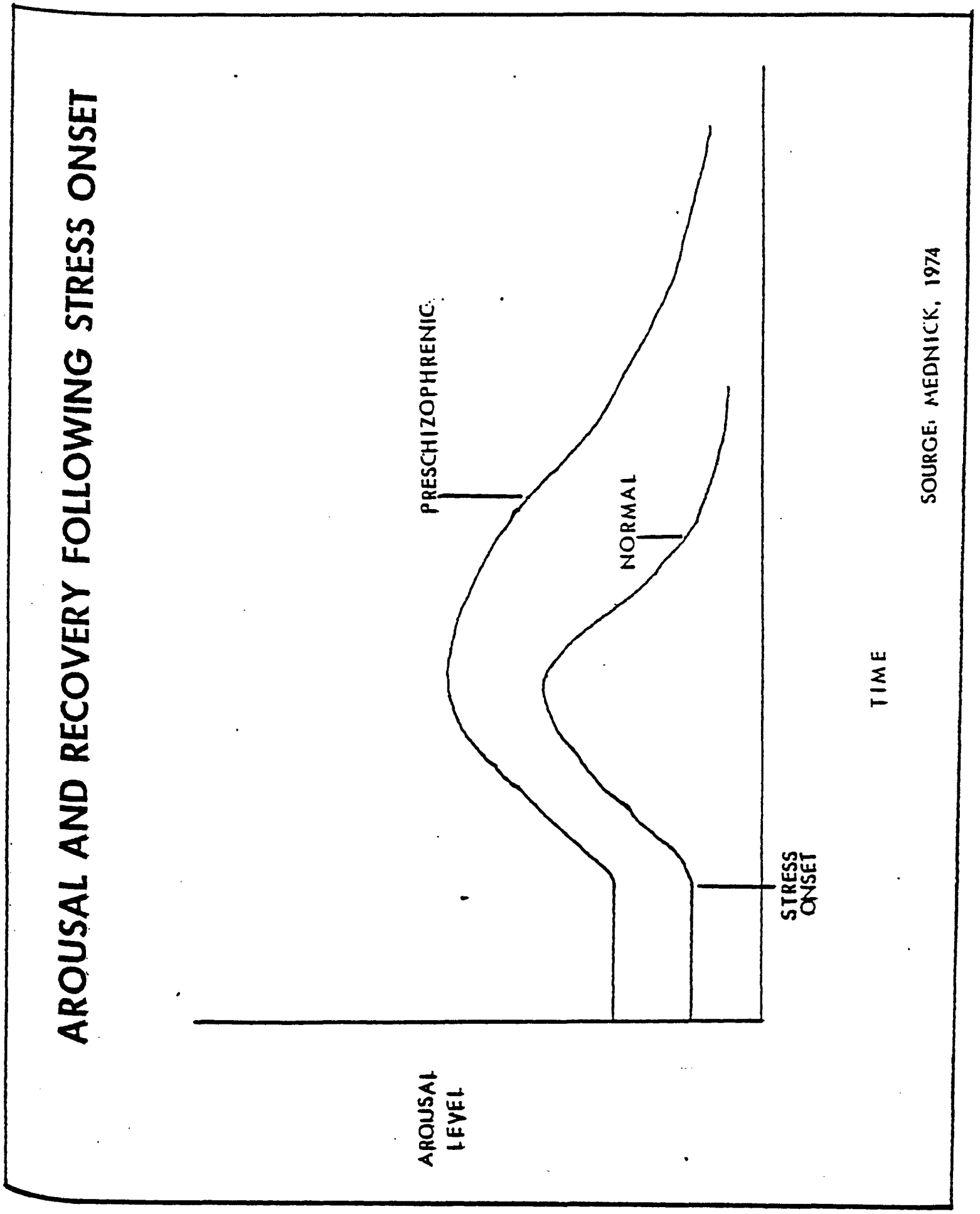



FIGURE 2

loneliness (Plunkett and Gordon, 1960, p. 27).

Mobility may also be associated with stress reactions. Faris and Dunham (1967) use home ownership as an index of mobility or stability in their study of Chicago. In sociological literature it is mentioned that a high degree of mobility leaves a person very unsettled, which may produce stress. People who rent do not have the security that owning a home can give.

Immigration, ethnicity and religion are variables, which may also cause stress. Some investigators regard the higher rates of admissions for some groups of immigrants as an indicator of their vulnerability to the stresses of immigration and to their striving in a climate of limited opportunity to try to break a cultural barrier (Allodi, 1978). Immigrants from Europe and North America are much closer to Canadians in terms of education and social status. Therefore they experience much less stress in coming to Canada, which can be seen in the lower mental hospitalization rates for Americans and Europeans compared to the people of Asian origin (Kleiner, 1959, p. 23).

The studies by Dunham (1965) and Faris and Dunham (1967) indicate the prevalence of schizophrenia in the central areas or CBD of Chicago and Detroit. These areas at the time of these studies happened to be the most disorganized and deteriorated areas of these cities. Disorganization and a deteriorated environment may be very stressful on the residents of the area (Faris and Dunham, 1967, p. 56).

Stress affects people through many facets of life, which may

deal with social, cultural and economic concerns. In order to understand schizophrenia better it is necessary to investigate whether or not the variables mentioned in the previous discussion in relation to stress are also related to the incidence of schizophrenia. However, this stress factor is not the only suggested theory for schizophrenia development. Therefore a basic understanding of schizophrenia is necessary. This understanding will be obtained through a brief discussion of the disorder of schizophrenia and its etiology.

What exactly is schizophrenia? This has been a controversial question for many centuries. Schizophrenia, like the unicorn, is described in various ways by various people (Salzinger, 1973, pp. 1-2). This gives one an idea of the many uncertainties with respect to the description, etiology and treatment of schizophrenia. Schizophrenia is viewed as a group of disorders or as Rosenthal (1968) suggests, "the schizophrenia spectrum." There are problems when trying to give a precise definition of schizophrenia or when trying to investigate it. It seems that schizophrenia possesses an array of characteristics and symptoms which have a unique interaction and a combination which differs among patients.

A number of major symptoms are associated with schizophrenia. Schizophrenics tend to display a great heterogeneity of symptoms (Mears and Gatchel, 1979). It is rare for a schizophrenic to display the entire range of symptoms all the time. Most patients experience some of the symptoms some of the time.

Disturbed thinking is the most typical and readily observable

symptom for the schizophrenic. The primary types of disturbed thinking are incoherence and delusions. Schizophrenics usually make verbalizations which are totally incoherent. The schizophrenic also has difficulty in sticking to one topic when speaking, which is termed loose association or overinclusion. The schizophrenic's mind tends to wander with no attempt to tie topics together. Neologisms are also common to the speech of the schizophrenic. A neologism is a new word, which the schizophrenic makes up (Mears and Gatchel, 1979). Schizophrenics also may use clang associations, which are a series of words linked together for no other purpose but that they rhyme. When the schizophrenic's speech loses all coherence it is referred to as word salad. This type of speech is totally disorganized.

Delusional thinking is the most common thought disorder present in the schizophrenic. Delusions are irrational beliefs that a person will defend even though the rest of society regards them as distortions of reality (Calhoun, 1977). There are several types of delusions. Delusions of persecution occur when the individual believes he or she is being plotted against, followed or listened to by others. Delusions of grandeur refer to the belief that one is some powerful or famous person such as Jesus Christ. Delusions of control occur when the patient feels he or she is being controlled by some alien force. Hypochondrical delusions distort reality in that the person believes he or she is afflicted by a bizarre somatic disorder, such as the "insides are rotting away" or the "brain is slowly disolving and shrinking" (Mears and Gatchel, 1979, pp. 192-193).

Another symptom deals with disorders of attention and perception. Research indicates schizophrenics perceive the world differently than normal individuals. One type of perceptual disorder is the hallucination, which is a sensory experience reported by a person in the absence of external stimulation from the environment (Calhoun, 1977). Auditory hallucinations are most common with visual experiences occurring less frequently.

Disorders of affect is another symptom, which the schizophrenic may display. Affect in this sense refers to emotion. There are three types of disturbance with respect to affect. The first is the condition of flat affect where no situation or person can elicit an emotional response. The second type of affective disturbance is inappropriate affect where the person displays an emotional response not suited to the situation. An example, would be giggling when told that someone died. Ambivalent affect is the third affective disturbance experienced by schizophrenics. In this case the patient experiences negative emotions toward a person or event (Mears and Gatchel, 1979, p. 195).

A symptom of schizophrenia may also appear in the motor behaviour of a person. Some experience an increase in their level of activity. Bizarre facial expressions and unusual body movements are often displayed by schizophrenics. On the other hand other schizophrenics experience an absence of motor behaviour. This is typical of the catatonic patient.

Finally, the social behaviour of the schizophrenic may be affected. He may become autistic, which is a state where one withdraws from reality and places an overemphasis on one's

fantasies. When discussing schizophrenia one may also refer to the dimensions of schizophrenia. The following are the dimensions of schizophrenia:

Process-Reactive

This dimension was developed by Kraepelin. It refers to the presumed etiology of the schizophrenia. The schizophrenia may have been organic in nature and the result of an abnormal biochemical or physiological process. On the other hand, the schizophrenia may have been the result of a reaction to a stress. The prognosis for improvement is generally better for reactive than for process schizophrenics.

Chronic-Acute

Acute scizophrenics display a very rapid onset of the symptoms of schizophrenia that tend to be precipitated by a stressful experience. Chronic schizophrenia is characterized by a gradual onset of symptoms. With respect to current research, chronic patients are those who have been hospitalized for more than two years whereas acute patients are hospitalized for shorter periods of time. The prognosis and release prospects for the chronic patients are very poor.

Nonparanoid-Paranoid

This dimension is based on the presence (paranoid) or absence (nonparanoid) of delusions of persecution or grandeur. Paranoid schizophrenics usually have a better prognosis, briefer hospitalization and fewer rehospitalizations.

Withdrawal-Activity

Schizophrenics on the activity end of the dimension show excessive and impulsive motor and verbal behaviour, greater degree of interpersonal contacts, less flat emotional affect and a low incidence of delusions and hallucinations than withdrawal schizophrenics. Activity schizophrenics have a better prognosis and faster recovery rates. (Mears and Gatchel, 1979, pp. 201-204)

Besides the stress factor previously mentioned many researchers believe there is a genetic component in the development of schizophrenia. Family studies have indicated that the more closely one is related to a schizophrenic, the greater the chance that one will develop schizophrenia. This predisposition toward schizophrenia has also been shown in twin studies where environmental effects play less of a role. Some researchers tend to favour a combination of genetic and environmental factors as contributing to the development of schizophrenia. Other researchers have indicated biochemical and physiological factors in the development of schizophrenia.

Treatments have been developed for each of the factors believed to contribute to schizophrenia. Before the use of effective antipsychotic drugs and modern treatment techniques in the late 1950's and early 1960's, the prognosis for improvement for schizophrenics was poor. Now the prognosis for many of the people suffering from this disorder is hopeful.

One can see from the preceding, brief account about schizophrenia that it is a very complex disorder. A great deal of knowledge

exists with respect to schizophrenia but little agreement exists concerning just what schizophrenia is, how it develops and why. The present research concerns itself with the stress factor of schizophrenia development but one should keep the other factors in mind and not discard them.

## CHAPTER V

## PURPOSES OF THE STUDY

This study was designed to investigate the distribution of schizophrenia cases in the city of Windsor. The distribution will be looked at in terms of where the schizophrenia cases were located in the city of Windsor and also possible reasons for their location will be investigated. These goals will be accomplished through the use of a few hypotheses. These hypotheses were the following:

Hypothesis 1. The cases of schizophrenia will be distributed in such a way that the highest incidence rates will be located in the central or CBD section of Windsor and the incidence rates will decrease going away from the central area.

Central city concentration of the schizophrenia pattern has been observed for Chicago, Detroit and Providence, Rhode Island. This concentration seemed to be related to the disorganization and deterioration of the central part of the city or CBD (Dunham, 1965). Therefore it might be postulated that schizophrenia did not tend to be randomly distributed in communities. This led to the development of the second hypothesis, which was:

Hypothesis 2. The pattern of schizophrenia cases for Windsor will not be random.

The third hypothesis was developed on the basis of a variety of studies which related the incidence of schizophrenia to social, economic or cultural variables. This hypothesis was:

Hypothesis 3. The distribution of schizophrenia cases in Windsor will be related to the following parameters:

Variable 1. Number of persons per household, 1.

Variable 2. Number of persons per household, 2-10.

Variable 3. Own Residence.

Variable 4. University Educated.

Variable 5. Unemployment.

Variable 6. Age 15-44. (Age range where schizophrenia is most prevalent).

Rose (1955) emphasized that occupation and income were closely tied to one's socio-economic level while Hollingshead and Redleich (1958) mentioned that level of education was also somewhat indicative of one's socio-economic level. Stress, according to Dunham (1965), was more prevalent at lower socio-economic levels. He postulated that as one's socio-economic level decreased, stresses increased and as a result, one was more susceptible to the development of schizophrenia. Therefore it might be postulated that as occupation status, income level and education level decreased that stress will increase and rates of schizophrenia will also increase. However, for this study, which employed 1976 enumeration area data, only data on education and unemployment was available. As a result, only unemployment and education were used in the formulation of the third hypothesis.

Personal relationships were also important to the prevention of stress. Married people, according to Rose (1955), seemed to experience less stress than those who were single. This seemed to

be the result of the security and company that marriage can give to someone. This was postulated as the reason why married people seemed to suffer less from schizophrenia.

One might live alone and not necessarily be single in the sense of marital status. Being alone could have resulted from divorce, separation or the death of a spouse. It has been found by(Plunkett and Gordon, 1960) that single person households tended to produce more schizophrenics than any other size of household because the stresses and anxieties experienced by these people were usually great. Therefore one could postulate that as the number of people in a household increased, the incidence of schizophrenia should decrease. Hence the use of variables one and two in the formulation of the third hypothesis.

The act of moving might be described as being very stressful. If one were not stable in terms of residence one might feel very insecure and this might lead to severe stress. Mobility, according to Faris and Dunham (1967), was higher among those who rent and do not own their own residence. Just as stress seemed to characterize a mobile population, schizophrenia rates were also found to be high among mobile populations. Therefore the variable of owning one's residence was used in the third hypothesis as a measure of stability.

The evaluation of the proposed hypotheses through the verification or rejection of these stated hypotheses should indicate the degree to which the various cultural, social and economic variables mentioned previously affect the distribution

of schizophrenia. Finally, an index of age was used in the third hypothesis because it has been found that people between the ages of 15-45 were more susceptible to developing schizophrenia. It was necessary to use this variable of age to determine if this played a role in the distribution of the schizophrenia cases in Windsor.

## CHAPTER VI

## DATA SOURCES

For this study the data were derived from the admission records of St. Thomas provincial mental hospital and from computer tapes containing 1976 census data at the enumeration area level. The data from St. Thomas was supplied on a list, which also included the patient's birthdate, place of birth, occupation and address. The patients on this list were the people of Windsor who were diagnosed as schizophrenic from January 1, 1978 to June 30, 1980. However, St. Thomas is a provincial hospital and as a result, only more chronic cases of schizophrenia were found here. Therefore the patients on the supplied list were actually those diagnosed schizophrenic and who did not recover after a period of local hospitalization. When these patients did not recover in the local hospitals of Windsor they were transferred to St. Thomas. As a result, this study will not actually deal with all the schizophrenia cases in Windsor but only those chronic cases transferred to St. Thomas. The number of chronic cases for Windsor supplied by St. Thomas for this research was one hundred and two. This was not a large sample but this number of cases was deemed sufficient as a basis for some preliminary research.

Data in terms of schizophrenia cases was only obtained from St. Thomas because it was the only institution willing to cooperate with such research into mental disorders. An attempt was made to obtain data on schizophrenia cases from local hospitals in Windsor but the administrators of these hospitals would not allow

the use of their data in this research. This denial under the provisions of the Ontario Mental Health Act was unfortunate, but probably reflected more of a shortage of staff to extract data rather than an unwillingness to assist in research.

Obtaining data on mental disorders was not an easy task. This type of medical data was considered to be very confidential because the possible misuse of such data would amount to an invasion of privacy. A letter from the human ethics committee was sent to each of the local hospitals as well as to St. Thomas in order to secure the data. However, the administrator at St. Thomas was the only one who felt that the confidential data he would supply would remain confidential and could be given without actual names. The administrators from the local hospitals, however could not supply data for this research in a suitable format that would ensure this confidentiality.

Another problem with the sample data used in this research dealt with the diagnosis of cases of mental disorders. The exact diagnosis of a mental disorder was not an easy task because symptoms might not always be consistent in all patients or sometimes the symptoms of one disorder might be very similar to the symptoms of another disorder. Also Hollingshead and Redleich (1958), found that people of lower socio-economic status were usually diagnosed psychotic (schizophrenia is a psychosis) and those of higher socio-economic status were usually diagnosed as being neurotic. This indicated a bias in the diagnosis of patients with respect to mental disorders.

As a result, some of the schizophrenia cases used in this

research might not be schizophrenic but might be better diagnosed as another type of mental disorder. Therefore this research has dealt with a sample not only limited to chronic cases but also a sample which might have a diagnosis bias. However, when dealing with research on mental disorders one has to be satisfied with the data supplied as well as accept the data as being reasonably consistent. Hopefully, these limits on the schizophrenia case data did not invalidate the study, but assumptions and curtailments were imposed on the researcher. Deductions from the results of this research were possible but caution was taken with respect to how they were stated and what they implied.

The other data source used in this study was the computer tapes containing 1976 census information at the enumeration level. This was obtained through the use of a computer program, which extracted the necessary information from the tapes. Information dealing with five pertinent variables was sought. The first variable was age. From the computer tapes a breakdown of ages were obtained from under age one to one hundred years of age and over. The age groupings were for example, one to four, five to nine, ten to fourteen and fifteen to nineteen. The total number of people in each of the age groupings for each of the enumeration areas was obtained. Also these totals were divided into the number of males and females in each of the age groups for each enumeration area. The second variable for which information was needed was the ownership of one's residence. The computer printout supplied the total owned private dwellings for each enumeration area. Therefore this included private dwellings such as homes and apartments if they were owned by their occupants. Thirdly, information on the number of persons per household was sought for use in this study. Information was

supplied on the total number of households in each of the two hundred and ten enumeration areas with one resident, two residents, three residents, four residents, five residents, six residents, seven residents, eight residents, nine residents and ten or more residents. The fourth variable required in this study was unemployment. The total number of persons unemployed in each of the enumeration areas was supplied. This total was divided into the number of males and females who were unemployed in each of the enumeration areas. The final variable for which information was needed was university education. For each enumeration area the total number of persons with some university education was obtained on the printout along with this total divided into the number of males and females with university education. Another important piece of information obtained from the computer tapes was the total population of each of the enumeration areas. This piece of data was important in figuring rates of schizophrenia for the enumeration areas.

The census data from the computer tapes was very useful in evaluating the third hypothesis in this study. However, this data has a problem in that it is rounded to zero or five. For example, if the true value for an enumeration area was forty-two this value would be rounded and reported on the computer tape as forty. Also if the true value for an enumeration area was forty-four this value would be rounded and reported on the computer tape as forty-five. As a result, the results of this study were influenced by this rounding practice.

From the preceding discussion on data sources one can see that there were problems associated with the data sources used in this thesis. Hopefully, no great influence resulting from these data problems were evident in the results of this research. To ensure reliable results caution was taken in interpreting the results of this study.

## METHODOLOGY

### PRELIMINARY ANALYSIS

Before the actual analysis of the St. Thomas data was undertaken a preliminary investigation of this data was done. This investigation was geared to look at the breakdown of these schizophrenia cases in terms of their month of birth, age, sex, occupation and the location of their birth. The list of chronic schizophrenia cases given by St. Thomas was scrutinized in order to determine the percentage of these cases which were male or female, the percentage of these cases who were in the age range of fifteen to forty-five (age range where schizophrenia is most prevalent), the percentage of these cases born in each month, the percentage of these cases born outside Windsor or Canada and finally the percentage of these cases in the various occupations given. In order to visualize the actual makeup of these schizophrenia cases it was necessary to look at these cases outside the statistical context employed in this thesis. As a result, patterns with respect to the data itself might prove themselves evident. From

this preliminary analysis actual statements concerning the schizophrenia cases in Windsor might be put forward before the pattern of these cases was analyzed and statistical inferences about schizophrenia cases in Windsor were made. In other words, this preliminary analysis aided in giving one an idea of what the schizophrenia patients from Windsor were like. It also aided in guiding one to look at certain relationships, such as age, which might have affected the overall distribution of schizophrenia cases in Windsor.

Part 1

The first step in the actual analysis of the St. Thomas data was to plot the addresses of each case from Windsor. These addresses were to be plotted on an enumeration area base map of Windsor. However, in this case the enumeration area map obtained from City Hall's Planning Department was too large to be reduced to a single page size base map, which would show the detail required. As a result, five base maps each showing a different section of Windsor were drawn. These base maps were drawn on the basis of the five planning districts in Windsor and each illustrated the enumeration areas located in it. These enumeration areas were obtained from a 1976 census map and therefore provided the latest available breakdown of Windsor into enumeration areas since information from the 1981 census was not available. Therefore the pattern of schizophrenia cases was plotted on a series of five maps, each reduced to page size.

In order to plot the addresses of each of the schizophrenia

cases from Windsor a map and atlas both making reference to street names in Windsor were used. These materials allowed one to locate the street, which each case had listed as their address. The map and atlas of street names also provided block numbers, which allowed for a more exact estimation of the location of each address. For the one hundred and two cases of schizophrenia provided by St. Thomas the address of the patient was found and a dot placed on the enumeration area maps. A few reference streets have been included on the enumeration area maps in order to aid those reading this study in locating the cases. After the dot maps illustrating the location of the addresses of the schizophrenia patients were drawn they were studied in order to determine if the dots exhibited any kind of pattern. A general discussion of the schizophrenia case pattern in Windsor was included in this study before the dot maps were subjected to statistical analyses.

Part 2

The second part of the actual analysis of the schizophrenia data involved the testing of the hypotheses mentioned in the 'Purpose of the Study' section of this paper. The first hypothesis given was that the cases of schizophrenia will be distributed in such a way that the highest incidence rates will be located in the central or CBD section of Windsor and the incidence rates will decrease going away from the central area. In order to evaluate this hypothesis the pattern of cases on the five enumeration area maps was carefully scrutinized. An account was given as to whether or not the highest incidence or in this case the greatest

number of cases of schizophrenia occurred in the CBD section of Windsor. The delineation of the CBD for Windsor was obtained from the thesis on Poverty Pockets done by Lorna Oliver in 1977. The overall pattern of schizophrenia cases was looked at to determine whether or not the pattern fit the description in the first hypothesis. If the pattern of schizophrenia cases seemed to be concentrated in the CBD with the number of cases decreasing away from the CBD then hypothesis number one was accepted. However, if the pattern of schizophrenia cases did not resemble the description in the first hypothesis, this hypothesis was rejected.

One point, which should be mentioned, was that hypothesis number one was not intended to be taken as solely a spatial hypothesis. This hypothesis was thought to be important not for the spatial locations but for the characteristics of these spatial locations. In other words, it was not the location of the area which was related to the schizophrenia cases but instead the characteristics of the areas which were related to the schizophrenia cases. These characteristics might be social, cultural, economic, religious, educational or political to name a few.

As a result, the spatial validity of the first hypothesis was examined at this point in the analysis. However, later in the analysis some characteristics of the areas were investigated to determine reasons for areas of high and low schizophrenia case concentration. This accounted for the pattern of schizophrenia

cases in Windsor outside of the spatial context. The characteristics of the enumeration areas were obtained from 1976 census tapes with enumeration area level data along with previous theses in this department which have dealt with social, economic or cultural factors in Windsor. None of these theses employed enumeration area base maps in their studies and as a result, extrapolation from their maps to enumeration area maps was made.

To further investigate the spatial aspects of the schizophrenia case pattern in Windsor, the second hypothesis was developed. It stated that the pattern of schizophrenia cases for Windsor will not be random. In order to test this hypothesis quadrat and point pattern analysis were used.

Firstly, a point pattern analysis was done to specifically search for patterns in the dot maps. A Nearest Neighbour analysis (Dacey) was implemented to assess the point pattern distribution for the schizophrenia cases in Windsor. The method was based upon the distance between all pairs of nearest neighbours (dij) for each point. The mean was taken for all these distances and yielded:

$\bar{r}_a = \frac{\sum dij}{N}$, N being the total number of observations. This gives an empirical or actual average distance.

In order to make any general comparisons between these particular distributions, one needed a standard to which each could be related. To calculate what the average spacing distances

would be if the observed distribution were random, a comparison with the Poisson Probability Function was used. The Poisson distribution was needed to derive expected average nearest neighbour distances for a randomly generated pattern. Now, under the assumption of randomness, the expected mean distance between points should be:

$\bar{r}_e = \frac{1}{2} (N/A)^{\frac{1}{2}}$ where N equals the number of points and A equals area.

The difference between these two values clearly measured the divergence of the actual point pattern ($\bar{r}_a$) from randomness ($\bar{r}_e$). The deviations from randomness were assessed by the r-rule, based on the relationship $\bar{r}_a/\bar{r}_e$ and :

a) if $\bar{r}_a/\bar{r}_e = 1.0$, then the point pattern was random.

b) if $\bar{r}_a/\bar{r}_e \longrightarrow 0$, then the pattern tended to be more clustered.

c) if $\bar{r}_a/\bar{r}_e > 1.0$, then the pattern tended towards dispersal and uniformity.

In order to test statistical null hypothesis ($H_0$) that the pattern did not depart significantly from random, the following procedure was used:

The null hypothesis ($H_0$) was stated: $\bar{r}_a = \bar{r}_e$ or $\bar{r}_a - \bar{r}_e = 0$. The significance level was set at .05 and the region of rejection was defined by finding $Z_{critical}$, which was equal to 1.96. The expected variance or standard error term was found by:

$$S.E._2 = \frac{0.26136}{(N^2/A)^{\frac{1}{2}}}$$

This standard error was interpreted with approximately 95 percent

of random pattern $\bar{r}_e$ values within $\pm$ 2 S.E. $\bar{r}_e$ of the computed value. In order to test statistically a $Z_{variate}$ must be computed.

$$Z_{observed} = \frac{\bar{r}_e - \bar{r}_a}{S.E._2}$$

If $|Z_{observed}| > Z_{critical}$, $H_0$ was rejected and it was inferred that the pattern departed significantly from random.

Secondly, Quadrat Analysis supplied one approach which allowed one to make inferences about the factors controlling the spread or degree of dispersion in spatial distributions. Quadrat counting methods involved statistical evaluation of agreement of quadrat counts of 'real world' points with hypothetical quadrat counts generated via the density functions of discrete probability distributions (McConnell, 1968).

The initial phases of quadrat analysis involved subdividing the map under study into equal area quadrats whose size was somewhere between 0 and A, where A equals the maps' total area. According to Curtis and McIntosh, this should be: quadrat area equals 2A/N, where N equals the number of quadrats.

However, in this present study of the schizophrenia cases in Windsor, which utilized enumeration area maps this division into quadrats was not necessary. In order to analyze the data in a quadrat analysis the enumeration areas, themselves, were used as quadrats. The quadrats were divided in this manner because the

enumeration areas were generally similar in size. Some enumeration areas were large and some were small but the majority were in a medium size range. Therefore the analysis was done on the basis of these quadrats in order to determine what type of results would come forth from such research.

Once the quadrats have been defined, the number of points in each quadrat were counted and this data was summarized on a histogram. The mean number of points per quadrat was calculated using the following formula for grouped data mean:

$$\bar{X} = \Sigma f_i (\hat{X}_i)/N, \text{ where } \bar{X} = \text{mean},$$

$f_i$ = frequency in class i, $X_i$ = number of points in class i and N = number of quadrats. Then the variance for the histogram was calculated from the formula:

$$s^2 = [\Sigma f_i (\hat{X}_i - \bar{X})^2]/(N-1), \text{ using the}$$

same notation as the preceding formula.

If $s^2 = \bar{X}$ or $s^2/\bar{X} = 1$, the pattern would probably be random; if $s^2/\bar{X} = 0$ or is a fraction, the pattern would probably be more uniform than random; and if $s^2/\bar{X} > 0$, this would suggest clustering in the pattern.

A quick test for either significant dispersion or clustering was the variance-mean ratio test. It involved a t-test of the null hypothesis ($H_0$) that $s^2/\bar{X} = 1.0$ or that the pattern was was generated by random process. The alternative hypothesis stated that the pattern was not generated by random process. The following procedure was used:

The significance level was set at the .05 level (one-tailed) and $t_{critical}$ was calculated for degrees of freedom N-1, where N = the number of quadrats. $t_{observed}$ was calculated from the formula:

$t_{observed} = S^2/\bar{X}-1.0/ (2/N-1)^{\frac{1}{2}}$ and if $t_{observed} > t_{critical}$, the null hypothesis was rejected. If the null hypothesis ($H_0$) was rejected, it implied that the pattern was not generated by a random process. As a result, one would return to the $S^2/\bar{X}$ ratio in order to choose other possibilities. If $S^2/\bar{X}$ was greater than 1.0, the pattern might have been generated by processes described by the Double Poisson Distribution, Thomas' Double Poisson Distribution, the Polya-Aeppli Distribution, the Negative Binomial Distribution or Neyman's Distributions. These distributions were used to describe more clustered than random patterns. On the other hand, if $S^2/\bar{X}$ was less than 1.0, the pattern might have been generated by the Negative Poisson or the Negative Double Poisson Distribution. These distributions were used to describe more uniform than random patterns.

In order to test for clustering or uniformness one of these theoretical distributions was chosen. From the results of the variance-mean ratio one determined if a theoretical distribution describing clustering or uniformness was needed. A comparison of the histogram data with the theoretical distributions was made. The procedure was as follows:

The null hypothesis ($H_0$), that the observed distribution was not significantly different from the theoretical distributions and the alternative hypothesis that the distributions were

significantly different were stated. The significance level was set at .05. An analysis table as shown, was set up by computing the cumulative relative proportions for both the observed and theoretical distributions.

ANALYSIS TABLE

| CLASS | OBSERVED PROPORTIONS | CUMULATIVE OBSERVED PROPORTIONS | CUMULATIVE THEORETICAL PROPORTIONS | DIFFERENCES |
|---|---|---|---|---|
| | | | | |

For this study an attempt was made to determine which of the theoretical distributions, describing a more clustered than random pattern, fit the observed pattern of schizophrenia cases in Windsor. Theoretical distributions describing more clustered than random patterns were tested because the pattern of schizophrenia cases was found to be clustered. Therefore the theoretical distributions tested were the Negative Binomial Distribution, the Double Poisson Distribution, Thomas' Double Poisson Distribution, the Polya-Aeppli Distribution and Neyman's Type A Distribution.

The cumulative Negative Binomial terms were calculated from a set of Negative Binomial tables produced by Williamson and Bretherton (1963) using the following parameters to find the appropriate cumulative densities:

$$p = \bar{X}/s^2 \qquad \text{and} \qquad k = \bar{X}p/1-p$$

The two cumulative density functions were compared in order to find the maximum difference for any pair of comparisons. This maximum difference was called $D_{maximum}$. A Kolmogorov-Smirnov One Sample table was used to find $D_{critical}$ at the .05 significance level. If $D_{maximum} > D_{critical}$ the null hypothesis was accepted. Otherwise the null hypothesis ($H_0$) was rejected and the alternative hypothesis was accepted. Then inferences were made. Therefore if the null hypothesis ($H_0$) was accepted, the pattern might be more clustered than random.

In this study, however, an attempt was made to determine which of the theoretical distributions possessed the best fit with the observed pattern of schizophrenia cases in Windsor. Therefore if, for example, the Negative Binomial distribution fit, other theoretical distributions were also tested. For the other theoretical distributions, which were tested in the same manner as the Negative Binomial distribution, theoretical cumulative proportions were calculated using a probability density function along with certain required parameters. The other theoretical distributions along with their probability density functions and parameters were the following:

Double Poisson Distribution

Probability density function: $p(x) = \frac{1}{2}(e^{-u'} u'^{x}/x!) + \frac{1}{2}(e^{-u''} u''^{x}/x!)$

where $u' = \bar{X} + (V-\bar{X}-\bar{X}^2)^{\frac{1}{2}}$ and $u'' = \bar{X}-(V-\bar{X}-\bar{X}^2)^{\frac{1}{2}}$, $\bar{X}$ = mean

$V$ = variance

Thomas' Double Poisson Distribution

Probability density function:

$$P(x) = \sum_{r=1}^{x} \left[(m^r e^{-m})r!\right]\left[((r\lambda)^{x-r}e^{-r})/(x-r)!\right]$$

where $m = \bar{X}/(1+\lambda)$ and $\lambda = \left[V-3\bar{X} + (5\bar{X}-2\bar{X}V-V^2)^{\frac{1}{2}}\right]/2\bar{X}$

Polya-Aeppli Distribution

Probability density function:

$$P(x) = e^{-m}\lambda^r \sum_{j=1}^{x} \binom{x-1}{j-1} (1/j!)\left[m(1-r)/r\right]^j$$

where $r = (V-\bar{X})/(\bar{X}+V)$ and $m = 2r\left[\bar{X}/(V-\bar{X})\right]$

Neyman's Type A Distribution

Probability density function:

$$P(x) = \left[(e^{-m1}m_2{}^x)/x!\right] \sum_{t=0}^{\infty} \left[(m_1 e^{-m2})^t t^x/t!\right]$$

where $m_1 = \bar{X}/V$ and $m_2 = (V-\bar{X})/\bar{X}$

and t is an integer.

Since the quadrat analysis ignored the arrangement of points, the nearest neighbour analysis overcame this problem and reinforced any inferences made as to the point pattern distribution. Therefore these analyses were used with respect to the distribution of schizophrenia cases in Windsor.

In order to test the third hypothesis proposed by this study, which stated that the distribution of schizophrenia cases in Windsor will be related to the following parameters:

Variable 1. Number of persons per household, 1.

Variable 2. Number of persons per household, 2-10.

Variable 3. Own Residence.

Variable 4. University Educated.

Variable 5. Unemployment

Variable 6. Age 15-44.,

an adequate statistical test was necessary.

These variables were chosen after an intensive search through the literature and were the characteristics referred to in the discussion of the testing of hypothesis number one. Variables were needed which would be good indicators of whether an area was predisposed to the development of schizophrenia. The variables used to test this hypothesis were those thought to be pertinent to Windsor as well as those for which 1976 enumeration area data was available.

The statistical test used to test the suitability of these variables to the Windsor case was a Step-Wise Discriminant Analysis. Bain (1972) employed a Multiple Discriminant Analysis in order to assess the socio-economic regionalization of Toronto. Oliver (1977) also employed a Multiple Discriminant Analysis to classify areas of Windsor on the basis of poverty and non-poverty.

The procedure of a Step-Wise Multiple Discriminant Analysis encompassed both predictive and inferential multi-variate statistical techniques. The purposes of Discriminant Analysis were the following:

1. to test for mean group differences and describe the overlaps among groups.

2. to construct classification schemes based upon a set of variables in order to assign previously unclassified observations to the appropriate groups.

In this study the Step-Wise Discriminant Analysis was used to determine the extent to which the variables or indicators discriminated between the high schizophrenia concentration and low schizophrenia concentration areas (enumeration areas) in Windsor. This methodology determined whether and to what extent different sets of indicators supported a classification. The discriminant procedure might be defined as "a set of rules or operations by means of which objects are assigned to one of the classes of a classification"(Casetti, 196? p. 6). This procedure allocated items to the nearest representative point of a class, in other words, to the class to which the item was more similar.

The Step-Wise Multiple Discriminant Analysis was set up using the instructions outlined by the Biomedical Manual for computer programs. The first matrix of the output was the combined group means on all indicators, followed by the group standard deviations. This was followed by the step-wise analysis which simply ordered the input data by indicators accounting for a decreasing amount of the total variance. The first indicator entered into the analysis was the most significant in explaining the classification .. which results.

The output also gave a canonical correlation matrix.

Canonical correlation was looked on as a generalization of multiple correlation. In canonical correlation there was more than one y-variable and "the objective was to find a linear compound of x-variables that has maximum correlation with a linear compound of y-variables"(Van de Geer, 1971, p. 156). The objective of this procedure was to find for the City of Windsor a certain combination of measurements which could be used to discriminate between areas with different concentrations or incidences of schizophrenia cases.

With respect to this study the Step-Wise Multiple Discriminant Analysis was done on two groupings of the enumeration areas based on the frequency of schizophrenia cases in each. The first run through of the procedure was based on groupings of enumeration areas classified with zero, one, two, three or four schizophrenia cases within them. However, this classification did not discriminate well with respect to the pattern of schizophrenia cases.

As a result, the enumeration areas were regrouped and classified on the basis of low, medium and high concentrations. In order to determine which enumeration areas possessed a high, medium or low concentration or incidence of schizophrenia cases crude incidence rates were calculated for each enumeration area. These crude incidence rates were calculated by dividing the number of schizophrenia cases in an enumeration area by the population of that enumeration area. The results were crude incidence rates

per 1000 for each enumeration area. Low concentrations were found in enumeration areas with a crude incidence rates of 0, medium concentrations were found in enumeration areas with crude incidence rates ranging from 1 per 1000 to 3 per 1000 and finally high concentrations were found in enumeration areas with crude incidence rates ranging from 4 per 1000 and over. This classification discriminated the variables used in hypothesis number three much better than the first. Therefore this run through of the Multiple Step-Wise Discriminant Analysis was used in the discussion of the analysis of the study.

# CHAPTER VII
# DATA ANALYSIS

## PRELIMINARY ANALYSIS

The results of the preliminary analysis of the data on schizophrenia cases in Windsor indicated a number of interesting trends. First, the age breakdown of these cases was investigated. It was found that the majority of these cases of schizophrenia fell within the age range of fifteen to forty-five years of age. This was indicated in the literature to be the age range where most diagnosed schizophrenics were found. In fact, for the data provided by St. Thomas, 75.36% of the male cases and 66.67% of the female cases happened to be in this age range, where there was a greater likelihood of the disorder. The greatest incidence of cases occurred in the male age range of twenty-one to thirty years of age. A total of thirty of the one hundred and two cases or 29.41% of the total cases fell in this age range. The next greatest incidence of cases was 16.67% of the total cases and this occurred in the male age range of thirty-one to forty years of age. Therefore, a more than ten percent difference between the two age ranges of greatest incidence was found. For the female age ranges the greatest incidence of schizophrenia was found among the thirty-one to forty years of age group with a 9.80% of the total cases. On the whole with respect to the sex breakdown of the one hundred and two cases the majority of these cases were male. Sixty-nine out of the one hundred and two cases, or 67.65% were male and thirty-three of the cases or 32.35% were female. Therefore, for the variables of age and sex the actual data supplied

by St. Thomas for Windsor seemed to support what the literature suggested about schizophrenia. In the literature it was suggested that more males than females were diagnosed schizophrenic and that the ages of greatest incidence were inside the range of fifteen to forty-five years of age.

This preliminary analysis also took a look into the birthdate pattern of these schizophrenia cases in terms of month of birth. February, with 15.69% of the schizophrenia cases being born within it showed the greatest incidence of schizophrenia. One might also speculate that the time of conception played a role in the highest incidence of schizophrenia being in February, correspondingly conception in May/June would produce higher incidences. The other months of the year did not show such a proclivity of schizophrenia cases. May and November were the months with the second greatest incidence of schizophrenia. Their percentage of cases was 9.80% which was about six percent less than February's mark. Table 1 illustrated the schizophrenia incidence for the remaining months of the year. July was found to be the month with the lowest incidence. Nothing in the literature mentioned any link between the development of schizophrenia and the month of the year in which one was born. Therefore maybe these findings for Windsor were just coincidence. However, further investigation should be made into this aspect of schizophrenia in order to see if month of birth might play a role in the development of schizophrenia.

TABLE 1

SCHIZOPHRENIA CASES BY MONTH OF BIRTH

| MONTH | NUMBER BORN PER MONTH | PERCENTAGE BORN PER MONTH |
|---|---|---|
| January | 9 | 8.82 |
| February | 16 | 15.69 |
| March | 8 | 7.84 |
| April | 6 | 5.88 |
| May | 10 | 9.80 |
| June | 9 | 8.82 |
| July | 5 | 4.90 |
| August | 8 | 7.84 |
| September | 7 | 6.86 |
| October | 6 | 5.88 |
| November | 10 | 9.80 |
| December | 8 | 7.84 |
| Total cases | 102 | 100.00 |

SOURCE: St. Thomas Admission Records, January 1, 1978 to June 30, 1980.

Occupation was also dealt with in this preliminary analysis. A great variety of occupations were represented in the data provided by St.Thomas. However, the greatest incidence of schizophrenia was found in the group with an occupation designated as labourer. This group possessed 16.67% of the total cases. The next highest concentration was found for housewives with 8.82%. The other occupations mentioned only had a few cases with the actual greatest percentage of the cases having an occupation which was not known. Table 2 indicated all the occupations mentioned from the data and the percentage of cases found in each. Patterns were hard to distinguish in terms of occupation because a great number of occupations were not known and a wide variety of occupations were designated by this data.

Finally, the preliminary analysis tried to find patterns in the place of birth of the schizophrenia cases found in Windsor. It was found that 48.04% of the cases were born outside of Windsor. In terms of country of birth, 84.31% of the cases were Canadian-born and 11.76% of the cases were born outside Canada. For four cases birthplace was not known. This did not indicate a prevalence of foreign-born schizophrenia cases in Windsor. Table 3 indicated the breakdown of foreign-born and native schizophrenia cases both on a federal and municipal level. This Table also provided the birthplaces of those cases born outside Canada. One was able to see that eleven out of the twelve cases came from cultures and languages far removed from what was native to Canada. Only the case from England had an easier time of accommodating himself to

TABLE 2

SCHIZOPHRENIA CASES BY OCCUPATION

| OCCUPATION | NUMBER OF CASES PER OCCUPATION | PERCENTAGE OF CASES PER OCCUPATION |
|---|---|---|
| Labourer | 17 | 16.67 |
| Housewife | 9 | 8.82 |
| Unemployed | 7 | 6.86 |
| Clerk | 4 | 3.92 |
| Draftsman | 3 | 2.94 |
| Student | 3 | 2.94 |
| Cab Driver | 2 | 1.96 |
| Auto Mechanic | 1 | 0.98 |
| Artist | 1 | 0.98 |
| Pipefitter | 1 | 0.98 |
| Nurse's Aid | 1 | 0.98 |
| Receptionist | 1 | 0.98 |
| Restaurent Operator | 1 | 0.98 |
| Truckdriver | 1 | 0.98 |
| Kitchen Help | 1 | 0.98 |
| Teacher | 1 | 0.98 |
| Machine Operator | 1 | 0.98 |
| Apprentice Carpenter | 1 | 0.98 |
| Railroad worker | 1 | 0.98 |
| Roofman | 1 | 0.98 |
| Sailsman | 1 | 0.98 |

TABLE 2 (Contd.)

| OCCUPATION | NUMBER OF CASES PER OCCUPATION | PERCENTAGE OF CASES PER OCCUPATION |
|---|---|---|
| Tobacco | 1 | 0.98 |
| Office Workers | 1 | 0.98 |
| Cabiner Maker | 1 | 0.98 |
| Stockman | 1 | 0.98 |
| Not Known | 37 | 36.27 |
| Total cases | 102 | 100.00 |

SOURCE: St. Thomas Admission Records, January 1, 1978 to June 30, 1980.

TABLE 3

SCHIZOPHRENIA CASES BY PLACE OF BIRTH

| OUTSIDE CANADA | NUMBER | INSIDE CANADA | NUMBER |
|---|---|---|---|
| Yugoslavia | 2 | Outside Windsor | 37 |
| Poland | 2 | Inside Windsor | 49 |
| China | 2 | Not Known | 4 |
| Lebanon | 2 | | |
| Finland | 1 | | |
| England | 1 | | |
| East Zorra | 1 | | |
| Italy | 1 | | |

(11.76% of total)

SOURCE: St. Thomas Admission Records, January 1, 1978 to June 30, 1980.

Canada since the cultures and languages were somewhat similar.

The results of this preliminary analysis gave a good indication of what the general patterns of schizophrenia cases in Windsor were like. These results readily led to further investigation into specific points of the schizophrenia patterns.

Part 1

This part of the analysis involved plotting the schizophrenia cases on a set of enumeration maps in order to determine if any pattern existed with respect to their distribution. Figure 3 illustrated the distribution of cases on a series of dot maps. At most only four cases were found in any enumeration area. The majority of enumeration areas, one hundred and fifty-eight, had no incidence of schizophrenia at all. These enumeration areas tended to be located toward the fringe areas of the City of Windsor. For example, the first map of the series illustrated the southwest area of the city. On this map only two schizophrenia cases were found and these were located in enumeration area number 357. This enumeration area was located more toward the central part of the city.

The second map of the series gave a picture of the northwest section of the city. Fifteen cases of schizophrenia were located on this map. Also the majority of these cases were in fairly close proximity to Huron Church Road. The remaining three cases

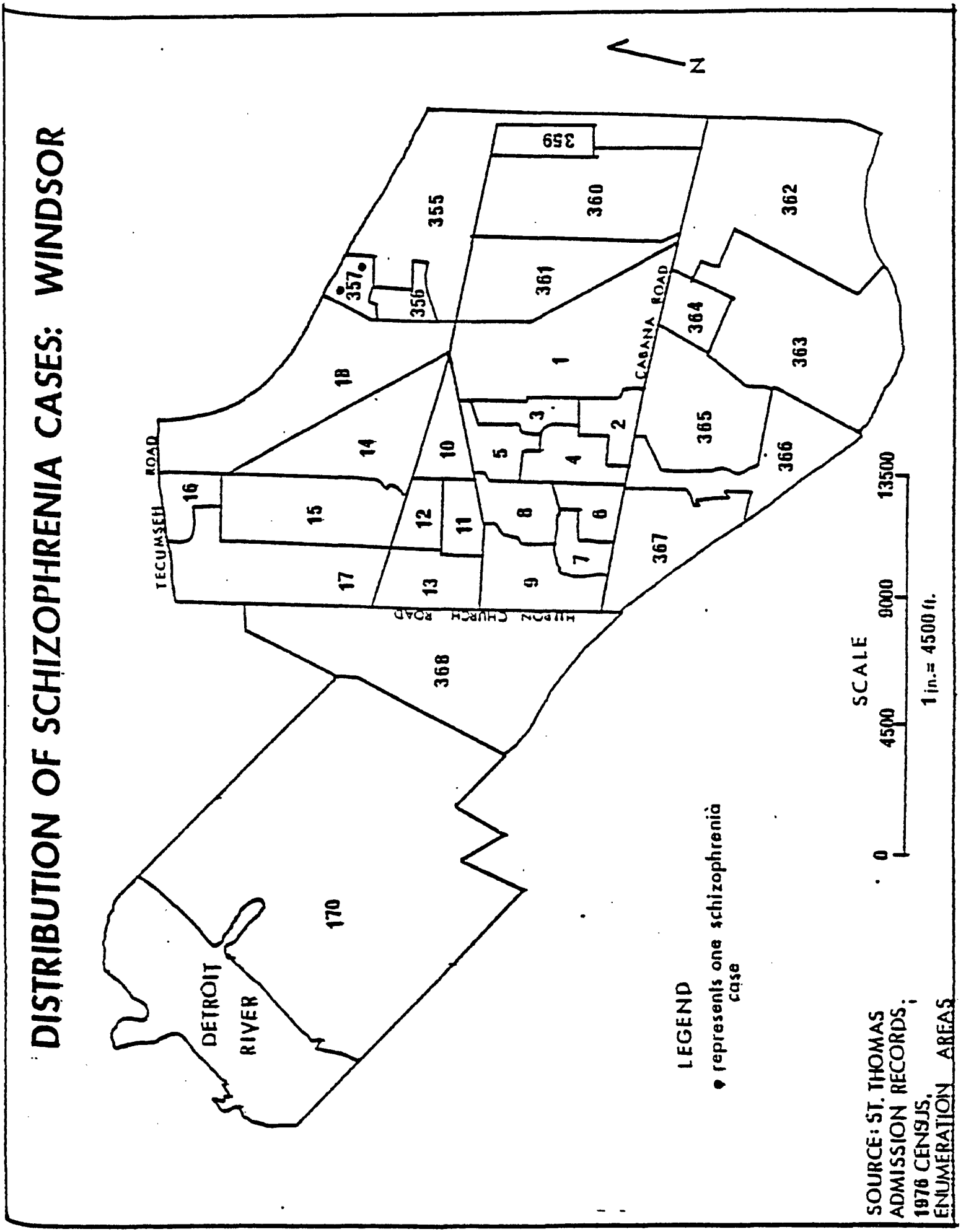



FIGURE 3-MAP 1

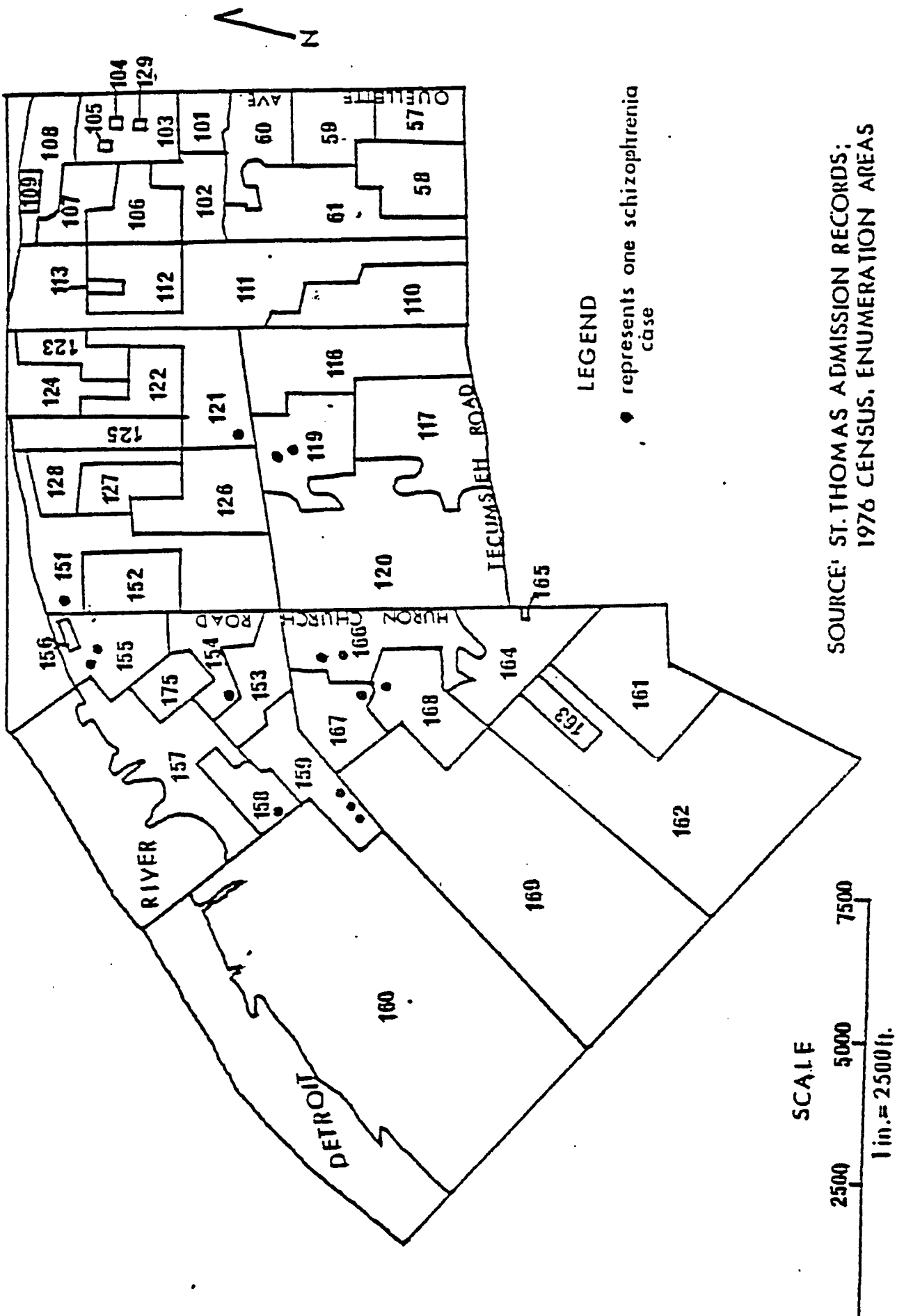



FIGURE 3

# DISTRIBUTION OF SCHIZOPHRENIA CASES:

## WINDSOR

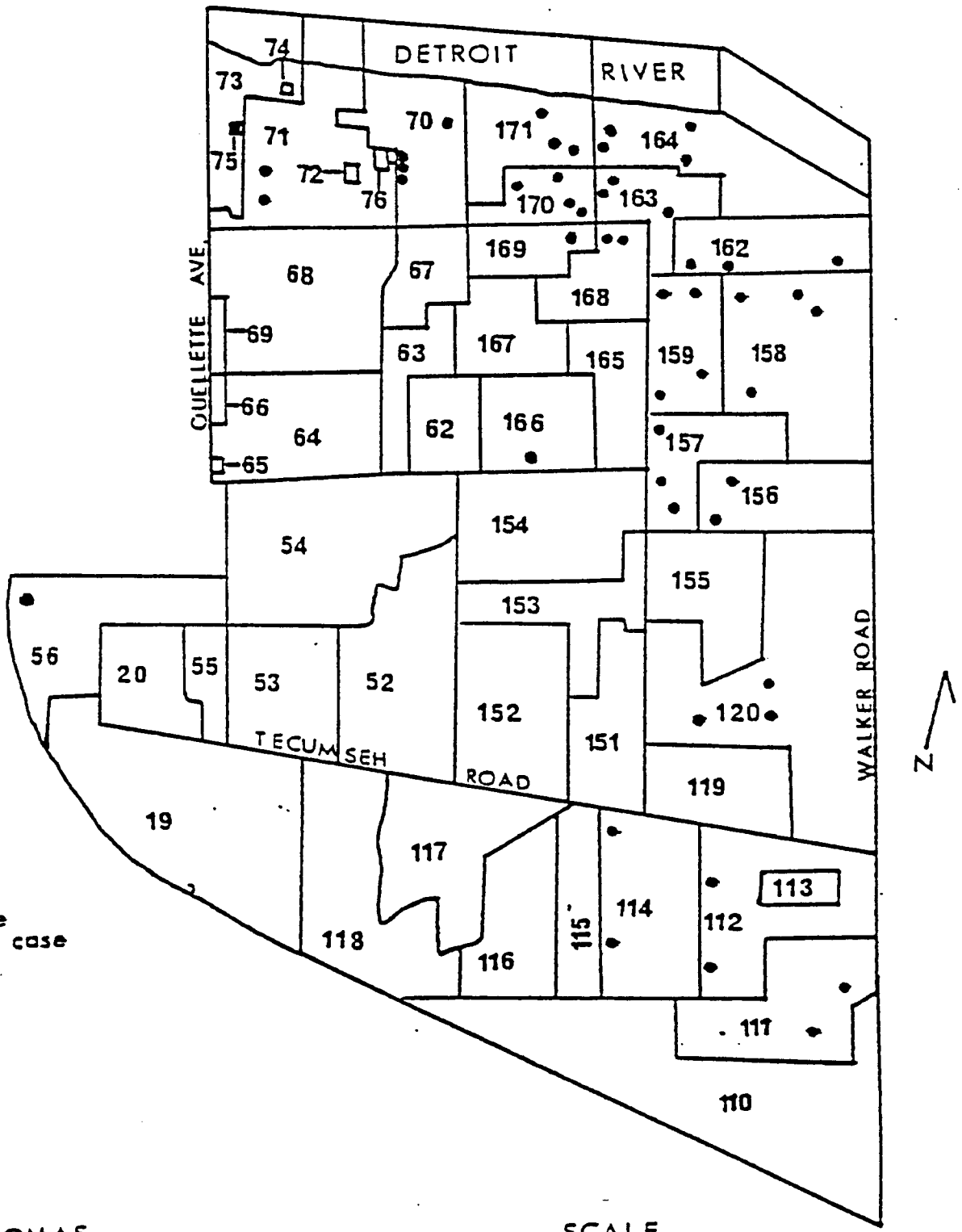



FIGURE 3-MAP 3

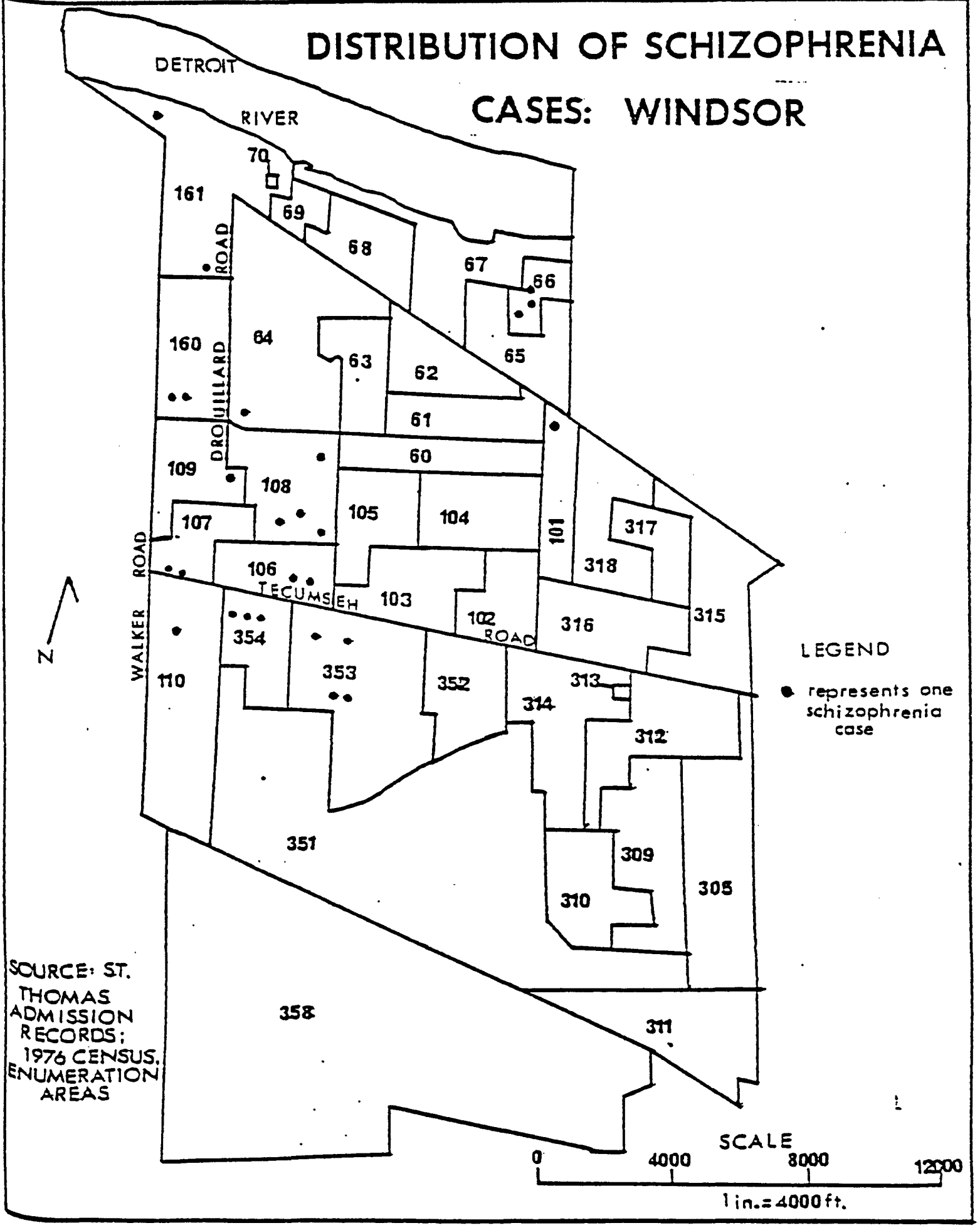



FIGURE 3-MAP 4

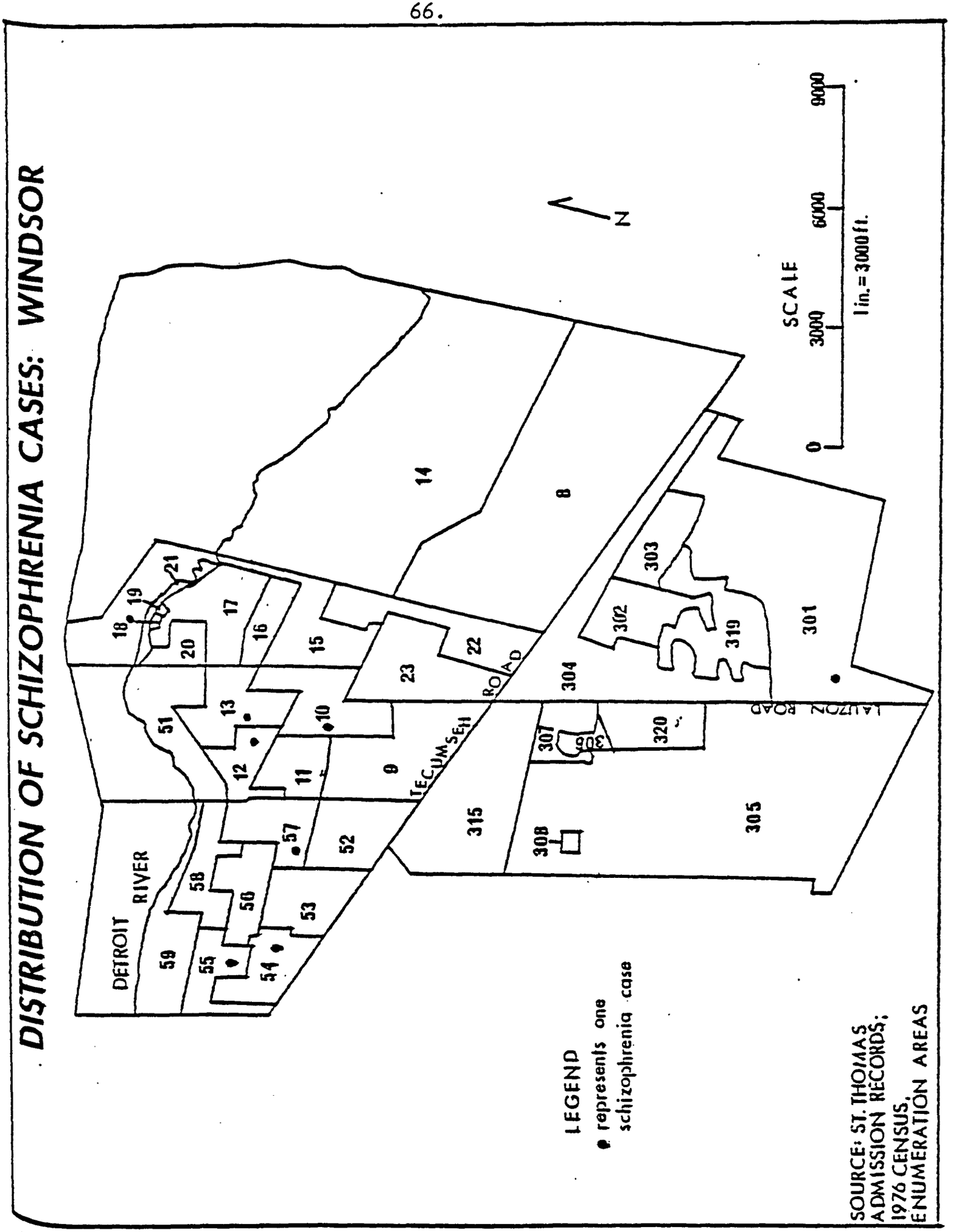



FIGURE 3-MAP 5

were found in enumeration areas 119 and 121. These areas were located about midway between Huron Church Road and the CBD area of the city.

The majority of the schizophrenia cases were located on map three of the series. Fifty-one cases of schizophrenia were located on this map. The majority of the schizophrenia cases on this map were located just south of the Detroit River between Riverside Drive to the north and Giles Blvd. to the South. The east-west boundaries of the area were Walker Road to the east and Howard Avenue to the west. This area included the enumeration areas 70,71, 75, 76, 170, 171, 169, 168, 164, 163, 162, 159, 158, 157, 156 and 166. This area encompassed the highest incidence of schizophrenia in the City of Windsor. The rest of this map illustrated a few isolated cases in the southeast section of the map.

Twenty-six of the schizophrenia cases were located on map four of the series. The majority of these cases were situated in the central western section of the map. These cases were found between Walker Road, Central Avenue, Grand Marais Avenue and Seminole Street, A few other cases were found on the fringes of this map. The cluster located on map number four was secondary to the large cluster located on the third map.

Finally, the fifth map of the series possessed only eight

cases of schizophrenia. These cases were scattered mostly in the northwestern section of the map. One case was situated in enumeration area number 301 which was located in the Forest Glade Area of the city. On this map enumeration areas 55,54, 57, 10, 12, 13 and 18 each have one schizophrenia case located in them.

Part 2

The analysis now turned to the testing of the three hypotheses proposed by this study. In order to verify or reject the first hypothesis the overall pattern of schizophrenia cases on the maps was investigated. From a look at the five maps it was evident that the greatest number of schizophrenia cases were not found in the CBD section of Windsor. Instead, the greatest number of schizophrenia cases were found just to the east of what was designated the CBD of Windsor. Oliver (1977) illustrated the CBD of Windsor as being bordered to the south by **Elliot Street and to the west by McDougal Avenue.** However, the pattern of schizophrenia cases was concentrated in a few clusters to the east of Pierre Avenue which meant that this pattern was not concentrated in the CBD. One did find though that the outer areas of Windsor located on maps one and five possessed a fairly small number of the schizophrenia cases. Therefore CBD concentration as hypothesized by hypothesis number one was rejected. Dunham and Faris found the pattern of CBD concentration in the mid-1960's, which was a period of time when many central city areas were disorganized and depressed. In present

times though central city areas have been found not to be so disorganized and depressed because of various renaissance projects. An example of such central city rejuvenation was found in Detroit where central city concentration of schizophrenia was found in 1965. As a result maybe if the pattern of schizophrenia cases had been investigated in the mid-1960's a pattern of CBD concentration might have been found. The CBD section of Windsor has undergone a rejuvenation in the past decade, which might have affected the pattern of schizophrenia cases. As a result, the area of schizophrenia concentration was investigated in hypothesis number three to determine whether the areas of schizophrenia case clustering possessed any variables, which were unique to these areas of clustering. This aided in providing an understanding of the pattern of schizophrenia cases outside of the spatial context indicated in hypothesis number one.

To test the second hypothesis, which dealt with the randomness of the pattern of schizophrenia cases in Windsor, both a nearest neighbour and a quadrat analysis were undertaken. The point pattern distribution used for the Nearest Neighbour Analysis was the actual pattern of schizophrenia cases shown on the dot maps in Figure 3. The quadrats used were the two hundred and ten enumeration areas found in Windsor.

The first step was to calculate the number of points in each quadrat. These values were given in Table 8 in the column, which

dealt with the frequency of cases in each of the enumeration areas. These frequency values represented the number of points found in each of the quadrats. The data was then summarized on a histogram which was illustrated in Figure 4. This figure indicated that 158 enumeration areas possessed no schizophrenia cases, 23 enumeration areas possessed 1 schizophrenia case, 9 enumeration areas possessed 3 schizophrenia cases and 6 enumeration areas possessed 4 schizophrenia cases. The mean number of points per quadrat was then calculated by the formula:

$$\bar{X} = \sum f_i \, (\hat{X}_i)/N$$
$$= 0.49$$

The variance was then calculated:

$$S^2 = \left[f_i \, (\hat{X}_i - \bar{X})^2\right]/N-1$$

In this case, $S^2 = 0.98$

The variance-mean ratio was then:

$$S^2/\bar{X} = \frac{0.98}{0.49} = 2.00$$

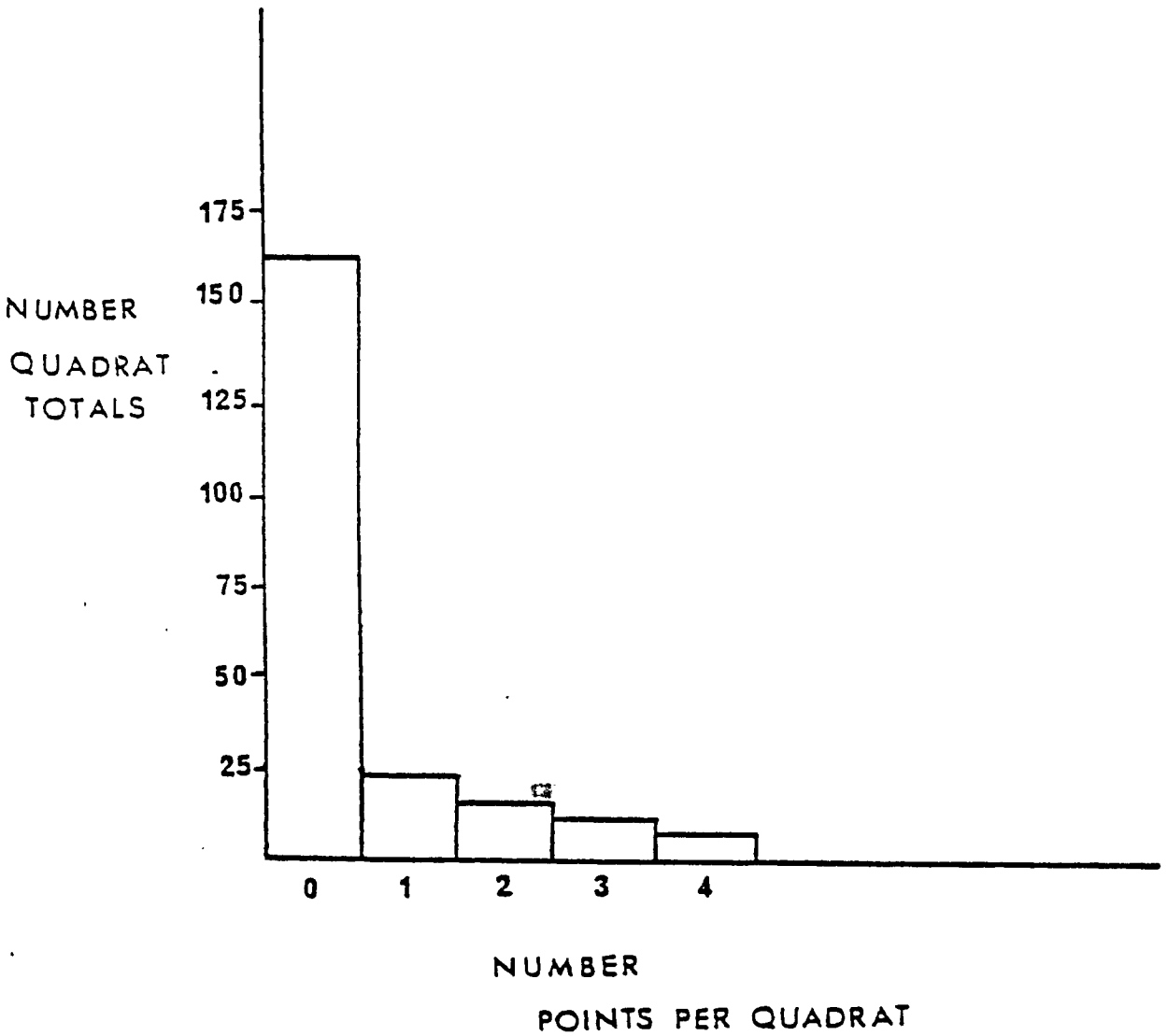
Since this ratio exceeded 1.00 the pattern was probably clustered.

Table 4 illustrated the Nearest Neighbour Analysis.

Table 5 showed the t-test for the variance-mean ratio and Table 6 illustrated the test to determine if the Negative Binomial distribution fit for the distribution of schizophrenia cases. Table 7 showed the attempt to fit the distribution of schizophrenia cases to a Double Poisson Theoretical distribution.

The fit of the other theoretical distributions describing clustered patterns was not shown because many difficulties were encountered and none of the other theoretical distributions produced a $D_{maximum}$ which was $<$ than $D_{critical}$ (0.094).

# HISTOGRAM OF THE DISTRIBUTION OF SCHIZOPHRENIA CASES




SOURCE: ST. THOMAS ADMISSION RECORDS

FIGURE 4

TABLE 4

NEAREST NEIGHBOUR ANALYSIS FOR THE DISTRIBUTION OF SCHIZOPHRENIA CASES

The procedure followed the following steps:

$N = 102$ $A = 44$sq. cm. (counted on a grid)

$\bar{r}_a = \frac{\sum d_{ij}}{N} = 0.364$

$\bar{r}_e = \frac{1}{2}(N/A)^{\frac{1}{2}} = 1.077$

$\frac{\bar{r}_a}{\bar{r}_e} = \frac{0.364}{1.077} = 0.338$

R-rule

a) if $\bar{r}_a/\bar{r}_e \approx 1.0$, then the pattern was random

b) if $\bar{r}_a/\bar{r}_e$ approaches 0, then the pattern tended to be clustered

c) if $\bar{r}_a/\bar{r}_e > 1.0$, then the pattern tended towards dispersal and uniformity.

Expected Variance:

$S\bar{r}_e = 0.26136/(N^2/A)^{\frac{1}{2}} = 0.017$

$Z_{observed} = r_a - r_e / Sr_e = -41.94$

$|-41.94| > 1.96$

Therefore, the pattern departed significantly from random.

Note:

$H_0$: The pattern did not depart significantly from random.

$H_a$: The pattern departed significantly from random.

Significance Level: .05, $Z_{critical} = 1.96$

SOURCE: Renaud, 1981.

TABLE 5

THE VARIANCE-MEAN RATIO TEST FOR THE DISTRIBUTION OF SCHIZOPHRENIA CASES

This was to test for significant clustering or dispersion in the form of a t-test.

$t_{critical}$ (one-tailed) 1.662

$t_{observed}$ $S^2/\bar{X}-1.0/(2/N)^{\frac{1}{2}}$ 7.092

Since $t_{observed}$ (7.092) $t_{critical}$ (1.662), the null hypothesis ($H_0$) was rejected and the distribution was inferred not to be random.

Note:

$H_0$: The pattern was generated by a random process.

$H_a$: The pattern was not generated by a random process.

Significance Level: .05

SOURCE: Renaud, 1981.

TABLE 6

TESTING WITH THE NEGATIVE BINOMIAL DISTRIBUTION

FOR THE DISTRIBUTION OF SCHIZOPHRENIA CASES

Analysis Table

| CLASS | PROPORTIONS OBSERVED | CUMULATIVE OBSERVED PROPORTIONS | NEGATIVE BINOMIAL CUMULATIVE PROPORTIONS | DIFFERENCES |
|---|---|---|---|---|
| 0 | 0.75 | 0.75 | 0.71 | 0.04* |
| 1 | 0.11 | 0.86 | 0.88 | 0.02 |
| 2 | 0.07 | 0.93 | 0.95 | 0.02 |
| 3 | 0.04 | 0.97 | 0.98 | 0.01 |
| 4 | 0.02 | 0.99 | 0.99 | 0.00 |

The cumulative Negative Binomial proportions were found in Williamson and Bretherton (1963) using the following parameters.

In this case:

$p = \bar{X}/s^2 = 0.50$ $\quad k = \bar{X}p/1-p = 0.50$

$D_{maximum} = 0.04$

$D_{critical} = 0.094$

Since $D_{maximum}$ (0.04) $<$ $D_{critical}$ (0.094), therefore, the null hypothesis ($H_0$) was accepted. This inferred the pattern was more clustered than random and that the observed distribution did not differ significantly from the theoretical Negative Binomial distribution.

Note:

$H_0$: The observed distribution was not significantly different from the Negative Binomial distribution.

$H_a$: The observed distribution was significantly different from the Negative Binomial distribution.

Significance Level: .05

SOURCE: Renaud, 1981.

TABLE 7

TESTING WITH THE DOUBLE POISSON DISTRIBUTION

FOR THE DISTRIBUTION OF SCHIZOPHRENIA CASES

Analysis Table

| CLASS | PROPORTIONS OBSERVED | CUMULATIVE OBSERVED PROPORTIONS | DOUBLE POISSON CUMULATIVE PROPORTIONS | DIFFERENCES |
|---|---|---|---|---|
| 0 | 0.75 | 0.75 | 0.70 | .05* |
| 1 | 0.11 | 0.86 | 0.87 | .01 |
| 2 | 0.07 | 0.93 | 0.96 | .03 |
| 3 | 0.04 | 0.97 | 0.99 | .02 |
| 4 | 0.02 | 0.99 | 100.00 | .01 |

The cumulative Double Poisson proportions were found by using the formula for the probability density function:

$$P(x) = \tfrac{1}{2}(e^{-u'} u'^{x}/x!) + \tfrac{1}{2}(e^{-u''} u''^{x}/x!)$$

and the parameters:

$$u' = \bar{X} + (V-\bar{X}-\bar{X}^2)^{\frac{1}{2}}$$

$$u'' = \bar{X} - (V-\bar{X}-\bar{X}^2)^{\frac{1}{2}}$$

where $\bar{X} = 0.49$

$V = 0.98$

found in McConnell (1968).

$D_{maximum} = 0.05$

$D_{critical} = 0.094$

Since $D_{maximum}$ (0.05) $<$ $D_{critical}$ (0.094), therefore, the null hypothesis ($H_0$) was accepted. This inferred the pattern was more clustered than random and that the observed distribution did not differ significantly from the theoretical Double Poisson distribution.

TABLE 7 (Contd.)

Note:

$H_0$: The observed distribution was not significantly different from the Double Poisson distribution.

$H_a$: The observed distribution was significantly different from the Double Poisson distribution.

Significance Level: .05

SOURCE: Renaud, 1981.

Both the Negative Binomial and the Double Poisson distributions were found to fit the pattern of schizophrenia cases in Windsor. However, the Negative Binomial produced a slightly better fit because it possessed a slightly smaller $D_{maximum}$ of .04. Through the Near Neighbour Analysis and the testing of the theoretical distributions it was proven that hypothesis number two was correct in stating that the pattern of schizophrenia cases in Windsor was not random.

What type of processes did produce the pattern of schizophrenia cases that existed in Windsor. Since these distributions describe clustered patterns some type of contagious processes were involved in developing the pattern. According to McConnell (1968) in the Double Poisson distribution the points were distributed as the mean of two equally important and independent processes arising from areal exclusiveness or inhomogeneity of events. On the other hand, the Negative Binomial distribution has been given two interpretations. It was assumed that the clusters were distributed randomly and the number per cluster followed a logarithmic distribution or the points were randomly distributed, but the mean value varied from place to place. It was difficult to determine exactly what processes caused the pattern of schizophrenia cases to take the form that it did. Also since two theoretical distributions were fitted to the pattern an attempt to find one set of processes that might account for the pattern was unsuccessful. Further study might be done in the future to determine exactly the processes

that shaped the pattern of schizophrenia cases in Windsor.

Testing of the third hypothesis in this study involved a Step-Wise Discriminant Analysis. The six variables entered into the analysis were tested to determine if they were significant in terms of indicating the schizophrenia pattern in Windsor. Table 8 was developed to show the values of the six variables which were entered into this analysis. The values were obtained from the 1976 Enumeration Area Census Tapes. The frequency column in this table indicated the number of schizophrenia cases in each enumeration area. These values were used to classify the enumeration areas for the first run through of the Discriminant Analysis. The CR per 1000 column in this table provided the values used in the second run through of the Discriminant Analysis. These CR's were the crude rates which were calculated in hopes they would provide a better means of classification. Finally, this table also illustrated the designation of the level of schizophrenia concentration in each of the enumeration areas based on the crude rates. The concentrations were designated as being low, medium or high. There were 160 enumeration areas designated low, 44 designated medium and 6 designated as high in concentration. The six enumeration areas with high concentrations were numbers 353, 66 and 108 found on map four of the series of enumeration area maps, 170, 75 and 76 found on map three of the series of enumeration area maps. The designations of each enumeration area were illustrated on Figure 5.

TABLE 8

SUMMARY TABLE OF VARIABLES USED IN STEP-WISE MULTIPLE DISCRIMINANT ANALYSIS

| ENUMERATION AREA | SIZE OF HOUSEHOLD (1) | SIZE OF HOUSEHOLD (2-10) | OWN RESIDENCE | UNIVERSITY EDUCATION | UNEMPLOY MENT | AGE (15-44) | FREQ | C.R. PER 1000 | CONCEN-TRATION |
|---|---|---|---|---|---|---|---|---|---|
| 301 | 15 | 490 | 475 | 35 | 45 | 1041 | 1 | 0 | L |
| 302 | 20 | 450 | 360 | 30 | 55 | 965 | 0 | 0 | L |
| 303 | 10 | 360 | 350 | 20 | 25 | 735 | 0 | 0 | L |
| 304 | 10 | 340 | 290 | 15 | 35 | 685 | 0 | 0 | L |
| 305 | 10 | 230 | 220 | 5 | 40 | 435 | 0 | 0 | L |
| 306 | 55 | 210 | 0 | 5 | 30 | 395 | 0 | 0 | L |
| 307 | 65 | 330 | 10 | 5 | 45 | 580 | 0 | 0 | L |
| 308 | 105 | 420 | 320 | 10 | 75 | 720 | 0 | 0 | L |
| 309 | 10 | 330 | 365 | 15 | 30 | 780 | 0 | 0 | L |
| 310 | 5 | 340 | 175 | 0 | 80 | 665 | 0 | 0 | L |
| 311 | 15 | 335 | 340 | 15 | 40 | 640 | 0 | 0 | L |
| 312 | 50 | 340 | 270 | 15 | 30 | 630 | 0 | 0 | L |
| 313 | 350 | 40 | 0 | 10 | 0 | 0 | 0 | 0 | L |
| 314 | 30 | 280 | 300 | 15 | 40 | 425 | 0 | 0 | L |
| 315 | 25 | 350 | 330 | 10 | 35 | 625 | 0 | 0 | L |
| 316 | 35 | 345 | 325 | 15 | 35 | 620 | 0 | 0 | L |
| 317 | 15 | 355 | 190 | 15 | 45 | 615 | 0 | 0 | L |
| 318 | 50 | 335 | 275 | 5 | 50 | 550 | 0 | 0 | L |
| 319 | 5 | 375 | 365 | 30 | 35 | 765 | 0 | 0 | L |
| 320 | 20 | 170 | 120 | 10 | 40 | 460 | 0 | 0 | L |

TABLE 8 (Contd.)

| ENUMERATION AREA | SIZE OF HOUSEHOLD (1) | SIZE OF HOUSEHOLD (2-10) | OWN RESIDENCE | UNIVERSITY EDUCATION | UNEMPLOY MENT | AGE (15-44) | FREQ | C.R. PER 1000 | CONCEN-TRATION |
|---|---|---|---|---|---|---|---|---|---|
| 351 | 40 | 310 | 320 | 10 | 40 | 460 | 0 | 0 | L |
| 352 | 70 | 300 | 315 | 0 | 45 | 485 | 0 | 0 | L |
| 353 | 65 | 295 | 305 | 5 | 20 | 385 | 4 | 4 | H |
| 354 | 40 | 295 | 285 | 15 | 40 | 260 | 3 | 3 | M |
| 355 | 30 | 300 | 265 | 15 | 45 | 510 | 0 | 0 | L |
| 356 | 60 | 280 | 280 | 5 | 30 | 485 | 0 | 0 | L |
| 357 | 55 | 270 | 270 | 15 | 25 | 430 | 2 | 2 | M |
| 358 | 40 | 200 | 270 | 0 | 15 | 475 | 0 | 0 | L |
| 359 | 55 | 280 | 280 | 15 | 40 | 430 | 0 | 0 | L |
| 360 | 25 | 335 | 350 | 25 | 40 | 675 | 0 | 0 | L |
| 361 | 10 | 140 | 125 | 5 | 10 | 245 | 0 | 0 | L |
| 362 | 50 | 160 | 195 | 0 | 0 | 260 | 0 | 0 | L |
| 363 | 20 | 300 | 300 | 20 | 25 | 505 | 0 | 0 | L |
| 364 | 30 | 290 | 305 | 15 | 25 | 470 | 0 | 0 | L |
| 365 | 25 | 395 | 405 | 20 | 55 | 600 | 0 | 0 | L |
| 366 | 10 | 380 | 365 | 15 | 20 | 645 | 0 | 0 | L |
| 367 | 10 | 340 | 340 | 25 | 50 | 665 | 0 | 0 | L |
| 368 | 15 | 210 | 195 | 10 | 30 | 350 | 0 | 0 | L |
| 8 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | L |
| 9 | 10 | 355 | 355 | 25 | 40 | 630 | 0 | 0 | L |
| 10 | 30 | 305 | 325 | 20 | 25 | 555 | 1 | 0 | L |
| 11 | 35 | 320 | 325 | 5 | 40 | 465 | 0 | 0 | L |
| 12 | 40 | 240 | 240 | 30 | 20 | 370 | 1 | 1 | M |

| ENUMERATION AREA | SIZE OF HOUSEHOLD (1) | SIZE OF HOUSEHOLD (2-10) | OWN RESIDENCE | UNIVERSITY EDUCATION | UNEMPLOY MENT | AGE (15-44) | FREQ | C.R. PER 1000 | CONCEN-TRATION |
|---|---|---|---|---|---|---|---|---|---|
| 13 | 45 | 315 | 295 | 5 | 45 | 465 | 1 | 1 | M |
| 14 | 45 | 430 | 430 | 20 | 70 | 690 | 0 | 0 | L |
| 15 | 85 | 405 | 265 | 15 | 40 | 665 | 0 | 0 | L |
| 16 | 60 | 275 | 115 | 5 | 30 | 425 | 0 | 0 | L |
| 17 | 85 | 375 | 330 | 40 | 60 | 690 | 0 | 0 | L |
| 18 | 175 | 100 | 0 | 10 | 15 | 105 | 1 | 2 | M |
| 19 | 185 | 145 | 0 | 25 | 0 | 70 | 0 | 0 | L |
| 20 | 95 | 215 | 120 | 30 | 15 | 335 | 0 | 0 | L |
| 21 | 95 | 240 | 300 | 20 | 35 | 260 | 0 | 0 | L |
| 22 | 0 | 200 | 195 | 20 | 25 | 400 | 0 | 0 | L |
| 23 | 0 | 215 | 210 | 10 | 35 | 450 | 0 | 0 | L |
| 51 | 75 | 320 | 290 | 20 | 45 | 470 | 0 | 0 | L |
| 52 | 40 | 355 | 315 | 15 | 45 | 710 | 0 | 0 | L |
| 53 | 40 | 305 | 315 | 10 | 35 | 500 | 0 | 0 | L |
| 54 | 30 | 310 | 330 | 10 | 55 | 470 | 1 | 1 | M |
| 55 | 80 | 265 | 255 | 5 | 45 | 435 | 1 | 1 | M |
| 56 | 50 | 255 | 265 | 15 | 30 | 430 | 0 | 0 | L |
| 57 | 15 | 305 | 260 | 25 | 55 | 565 | 1 | 1 | M |
| 58 | 155 | 145 | 180 | 25 | 35 | 485 | 0 | 0 | L |
| 59 | 50 | 290 | 305 | 35 | 15 | 370 | 0 | 0 | L |
| 60 | 60 | 360 | 370 | 10 | 45 | 570 | 0 | 0 | L |
| 61 | 90 | 325 | 305 | 5 | 45 | 490 | 0 | 0 | L |
| 62 | 40 | 200 | 290 | 5 | 75 | 425 | 0 | 0 | L |
| 63 | 50 | 275 | 250 | 5 | 65 | 420 | 0 | 0 | L |

| ENUMERATION AREA | SIZE OF HOUSEHOLD (1) | SIZE OF HOUSEHOLD (2-10) | OWN RESIDENCE | UNIVERSITY EDUCATION | UNEMPLOY MENT | AGE (15-44) | FREQ | C.R. PER 1000 | CONCEN-TRATION |
|---|---|---|---|---|---|---|---|---|---|
| 64 | 90 | 290 | 200 | 10 | 45 | 485 | 1 | 1 | M |
| 65 | 110 | 320 | 315 | 15 | 35 | 505 | 0 | 0 | L |
| 66 | 110 | 190 | 100 | 25 | 40 | 255 | 3 | 4 | H |
| 67 | 105 | 220 | 170 | 30 | 15 | 275 | 0 | 0 | L |
| 68 | 130 | 170 | 35 | 45 | 10 | 210 | 0 | 0 | L |
| 69 | 60 | 130 | 40 | 0 | 10 | 170 | 0 | 0 | L |
| 70 | 0 | 10 | 0 | 0 | 0 | 10 | 0 | 0 | L |
| 101 | 20 | 150 | 160 | 5 | 15 | 245 | 1 | 2 | M |
| 102 | 40 | 320 | 355 | 25 | 35 | 535 | 0 | 0 | L |
| 103 | 65 | 340 | 350 | 10 | 30 | 45 | 0 | 0 | L |
| 104 | 40 | 335 | 350 | 20 | 50 | 560 | 0 | 0 | L |
| 105 | 75 | 335 | 335 | 15 | 30 | 440 | 0 | 0 | L |
| 106 | 55 | 275 | 285 | 15 | 30 | 375 | 2 | 2 | M |
| 107 | 65 | 265 | 290 | 15 | 40 | 385 | 2 | 2 | M |
| 108 | 30 | 175 | 180 | 10 | 25 | 245 | 4 | 6 | H |
| 109 | 80 | 240 | 250 | 0 | 10 | 330 | 1 | 1 | M |
| 110 | 35 | 325 | 360 | 30 | 45 | 480 | 1 | 1 | M |
| 111 | 35 | 335 | 340 | 25 | 25 | 430 | 2 | 2 | M |
| 112 | 65 | 315 | 325 | 25 | 30 | 385 | 2 | 2 | M |
| 113 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | L |
| 114 | 60 | 315 | 335 | 30 | 30 | 375 | 2 | 2 | M |
| 115 | 30 | 160 | 175 | 5 | 15 | 195 | 0 | 0 | L |
| 116 | 55 | 255 | 300 | 15 | 45 | 375 | 0 | 0 | L |
| 117 | 80 | 290 | 305 | 15 | 45 | 380 | 0 | 0 | L |

| ENUMERATION AREA | SIZE OF HOUSEHOLD (1) | SIZE OF HOUSEHOLD (2-10) | OWN RESIDENCE | UNIVERSITY EDUCATION | UNEMPLOY MENT | AGE (15-44) | FREQ | C.R. PER 1000 | CONCEN-TRATION |
|---|---|---|---|---|---|---|---|---|---|
| 118 | 65 | 300 | 240 | 15 | 25 | 410 | 0 | 0 | L |
| 119 | 80 | 255 | 275 | 15 | 30 | 290 | 0 | 0 | L |
| 120 | 80 | 295 | 285 | 10 | 40 | 450 | 3 | 3 | M |
| 151 | 70 | 285 | 295 | 10 | 30 | 330 | 0 | 0 | L |
| 152 | 90 | 270 | 255 | 5 | 25 | 335 | 0 | 0 | L |
| 153 | 80 | 230 | 235 | 10 | 50 | 355 | 0 | 0 | L |
| 154 | 125 | 310 | 230 | 15 | 45 | 465 | 0 | 0 | L |
| 155 | 95 | 270 | 275 | 5 | 40 | 420 | 0 | 0 | L |
| 156 | 90 | 285 | 260 | 45 | 30 | 445 | 2 | 2 | M |
| 157 | 95 | 265 | 250 | 40 | 20 | 380 | 3 | 3 | M |
| 158 | 65 | 285 | 275 | 40 | 40 | 515 | 4 | 3 | M |
| 159 | 75 | 310 | 285 | 15 | 65 | 475 | 4 | 3 | M |
| 160 | 95 | 270 | 240 | 10 | 10 | 465 | 2 | 2 | M |
| 161 | 105 | 235 | 175 | 5 | 5 | 390 | 2 | 2 | M |
| 162 | 135 | 225 | 135 | 35 | 20 | 390 | 3 | 3 | M |
| 163 | 100 | 280 | 155 | 5 | 55 | 505 | 3 | 3 | M |
| 164 | 110 | 305 | 175 | 25 | 65 | 525 | 4 | 3 | M |
| 165 | 90 | 275 | 220 | 15 | 30 | 410 | 0 | 0 | L |
| 166 | 75 | 300 | 205 | 20 | 30 | 475 | 1 | 1 | M |
| 167 | 85 | 220 | 160 | 10 | 55 | 410 | 0 | 0 | L |
| 168 | 55 | 275 | 190 | 5 | 45 | 470 | 2 | 2 | M |
| 169 | 70 | 155 | 85 | 5 | 25 | 270 | 1 | 2 | M |
| 170 | 35 | 95 | 65 | 5 | 25 | 185 | 4 | 10 | H |
| 171 | 85 | 240 | 145 | 20 | 30 | 425 | 3 | 3 | M |

TABLE 8 (Contd.)

| ENUMERATION AREA | SIZE OF HOUSEHOLD (1) | SIZE OF HOUSEHOLD (2-10) | OWN RESIDENCE | UNIVERSITY EDUCATION | UNEMPLOY MENT | AGE (15-44) | FREQ | C.R. PER 1000 | CONCEN-TRATION |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 40 | 345 | 370 | 40 | 25 | 595 | 0 | 0 | L |
| 2 | 10 | 365 | 370 | 40 | 55 | 615 | 0 | 0 | L |
| 3 | 15 | 335 | 335 | 30 | 35 | 575 | 0 | 0 | L |
| 4 | 15 | 315 | 325 | 20 | 45 | 550 | 0 | 0 | L |
| 5 | 20 | 315 | 350 | 25 | 10 | 530 | 0 | 0 | L |
| 6 | 15 | 325 | 340 | 35 | 25 | 655 | 0 | 0 | L |
| 7 | 10 | 325 | 335 | 35 | 60 | 650 | 0 | 0 | L |
| 8 | 20 | 335 | 345 | 35 | 25 | 550 | 0 | 0 | L |
| 9 | 10 | 270 | 285 | 25 | 55 | 550 | 0 | 0 | L |
| 10 | 20 | 290 | 295 | 35 | 20 | 460 | 0 | 0 | L |
| 11 | 30 | 320 | 315 | 25 | 25 | 625 | 0 | 0 | L |
| 12 | 20 | 330 | 235 | 15 | 50 | 595 | 0 | 0 | L |
| 13 | 10 | 220 | 225 | 5 | 20 | 400 | 0 | 0 | L |
| 14 | 15 | 270 | 270 | 35 | 30 | 485 | 0 | 0 | L |
| 15 | 10 | 320 | 220 | 15 | 50 | 590 | 0 | 0 | L |
| 16 | 15 | 310 | 200 | 10 | 30 | 500 | 0 | 0 | L |
| 17 | 25 | 270 | 240 | 5 | 45 | 465 | 0 | 0 | L |
| 18 | 45 | 115 | 100 | 0 | 25 | 200 | 0 | 0 | L |
| 19 | 65 | 275 | 230 | 25 | 55 | 405 | 0 | 0 | L |
| 20 | 85 | 255 | 245 | 35 | 10 | 380 | 0 | 0 | L |
| 51 | 60 | 170 | 170 | 10 | 15 | 260 | 0 | 0 | L |
| 52 | 90 | 255 | 245 | 5 | 50 | 410 | 0 | 0 | L |
| 53 | 150 | 205 | 130 | 20 | 40 | 310 | 0 | 0 | L |
| 54 | 75 | 255 | 205 | 25 | 30 | 435 | 0 | 0 | L |

TABLE 8 (cont'd.)

| ENUMERATION AREA | SIZE OF HOUSEHOLD (1) | SIZE OF HOUSEHOLD (2-10) | OWN RESIDENCE | UNIVERSITY EDUCATION | UNEMPLOYMENT | AGE (15-44) | FREQ | C.R. PER 1000 | CONCENTRATION |
|---|---|---|---|---|---|---|---|---|---|
| 55 | 215 | 110 | 30 | 15 | 10 | 190 | 0 | 0 | L |
| 56 | 205 | 305 | 265 | 20 | 30 | 455 | 1 | 1 | M |
| 57 | 160 | 185 | 95 | 5 | 25 | 325 | 0 | 0 | L |
| 58 | 100 | 270 | 230 | 20 | 35 | 415 | 0 | 0 | L |
| 59 | 85 | 250 | 190 | 15 | 30 | 430 | 0 | 0 | L |
| 60 | 110 | 260 | 175 | 30 | 75 | 500 | 0 | 0 | L |
| 61 | 70 | 300 | 245 | 15 | 45 | 435 | 0 | 0 | L |
| 62 | 85 | 295 | 235 | 10 | 50 | 450 | 0 | 0 | L |
| 63 | 90 | 265 | 180 | 15 | 50 | 430 | 0 | 0 | L |
| 64 | 145 | 235 | 170 | 0 | 40 | 385 | 0 | 0 | L |
| 65 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | L |
| 66 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | L |
| 67 | 100 | 295 | 150 | 20 | 75 | 475 | 0 | 0 | L |
| 68 | 120 | 105 | 90 | 10 | 25 | 245 | 0 | 0 | L |
| 69 | 355 | 40 | 0 | 10 | 0 | 10 | 0 | 0 | L |
| 70 | 115 | 245 | 110 | 15 | 65 | 435 | 1 | 1 | M |
| 71 | 155 | 215 | 50 | 10 | 50 | 330 | 2 | 2 | M |
| 72 | 145 | 120 | 0 | 5 | 35 | 105 | 0 | 0 | L |
| 73 | 135 | 90 | 0 | 15 | 10 | 115 | 0 | 0 | L |
| 74 | 260 | 35 | 0 | 10 | 0 | 0 | 0 | 0 | L |
| 75 | 70 | 55 | 0 | 0 | 5 | 120 | 1 | 5 | H |
| 76 | 0 | 0 | 0 | 0 | 0 | 30 | 3 | 35 | H |
| 101 | 215 | 115 | 30 | 0 | 15 | 245 | 0 | 0 | L |
| 102 | 85 | 250 | 155 | 20 | 55 | 430 | 0 | 0 | L |

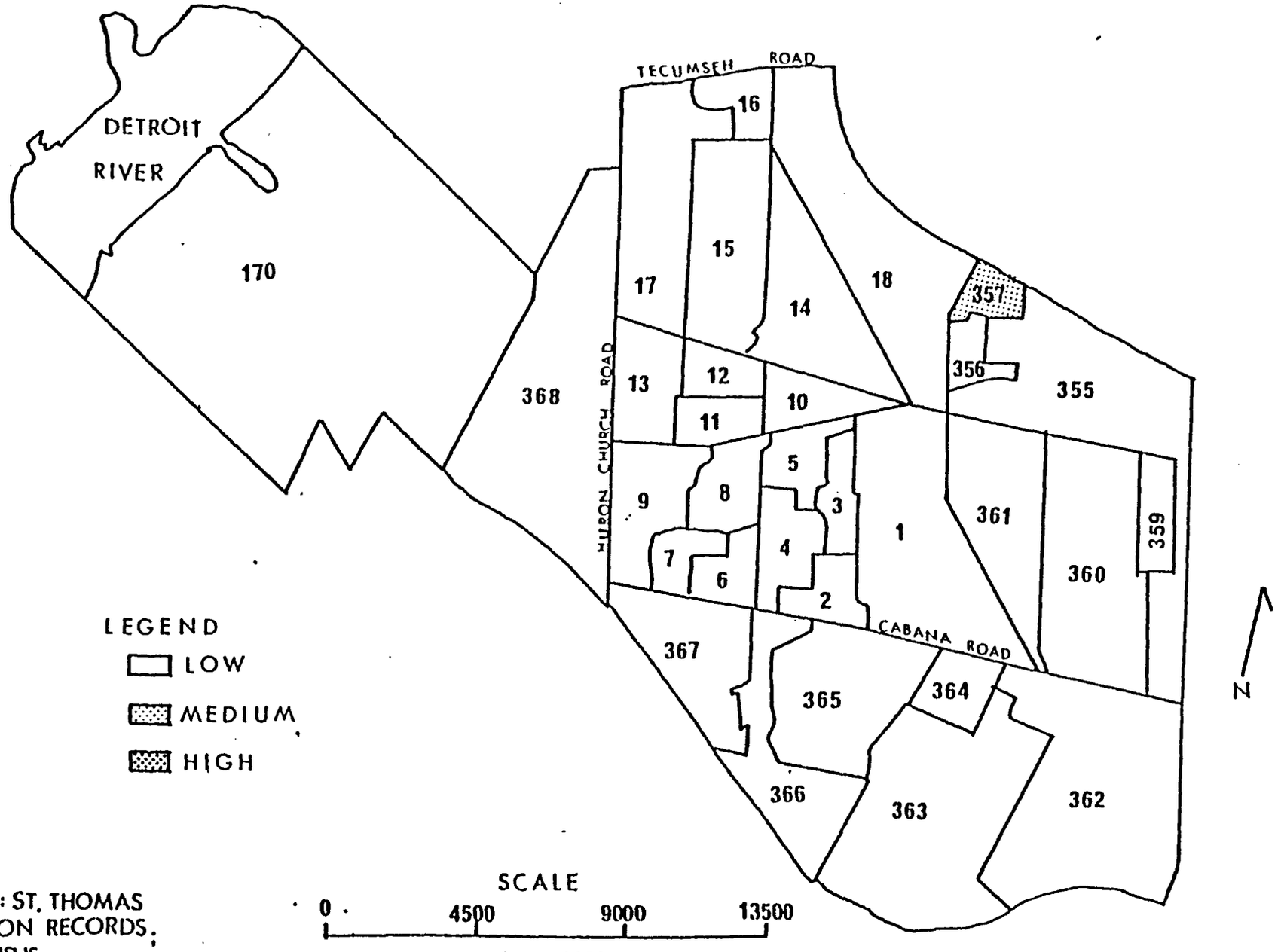
TABLE 8 (Contd.)

| ENUMERATION AREA | SIZE OF HOUSEHOLD (1) | SIZE OF HOUSEHOLD (2-10) | OWN RESIDENCE | UNIVERSITY EDUCATION | UNEMPLOY MENT | AGE (15-44) | FREQ | C.R. PER 1000 | CONCEN-TRATION |
|---|---|---|---|---|---|---|---|---|---|
| 103 | 195 | 130 | 45 | 20 | 35 | 240 | 0 | 0 | L |
| 104 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | L |
| 105 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | L |
| 106 | 130 | 265 | 115 | 10 | 60 | 505 | 0 | 0 | L |
| 107 | 145 | 135 | 45 | 15 | 50 | 295 | 0 | 0 | L |
| 108 | 95 | 45 | 5 | 0 | 20 | 90 | 0 | 0 | L |
| 109 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | L |
| 110 | 55 | 290 | 255 | 5 | 50 | 470 | 0 | 0 | L |
| 111 | 55 | 155 | 145 | 0 | 20 | 235 | 0 | 0 | L |
| 112 | 100 | 245 | 170 | 30 | 50 | 405 | 0 | 0 | L |
| 113 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | L |
| 114 | 165 | 270 | 125 | 20 | 50 | 375 | 0 | 0 | L |
| 116 | 65 | 335 | 275 | 30 | 60 | 585 | 0 | 0 | L |
| 117 | 30 | 350 | 305 | 10 | 35 | 550 | 0 | 0 | L |
| 118 | 115 | 20 | 0 | 0 | 5 | 5 | 0 | 0 | L |
| 119 | 50 | 360 | 305 | 10 | 55 | 625 | 2 | 1 | M |
| 120 | 30 | 375 | 290 | 40 | 65 | 770 | 0 | 0 | L |
| 121 | 85 | 245 | 195 | 10 | 30 | 430 | 1 | 1 | L |
| 122 | 80 | 260 | 175 | 20 | 35 | 430 | 0 | 0 | L |
| 123 | 55 | 145 | 80 | 5 | 25 | 290 | 0 | 0 | L |
| 124 | 95 | 225 | 135 | 10 | 35 | 450 | 0 | 0 | L |
| 125 | 80 | 280 | 195 | 20 | 50 | 435 | 0 | 0 | L |
| 126 | 65 | 300 | 245 | 20 | 25 | 500 | 0 | 0 | L |
| 127 | 140 | 285 | 180 | 30 | 70 | 500 | 0 | 0 | L |

Table 8 (cont'd.)

| ENUMERATION AREA | SIZE OF HOUSEHOLD (1) | SIZE OF HOUSEHOLD (2-10) | OWN RESIDENCE | UNIVERSITY EDUCATION | UNEMPLOY MENT | AGE (15-44) | FREQ | C.R. PER 1000 | CONCEN-TRATION |
|---|---|---|---|---|---|---|---|---|---|
| 128 | 115 | 240 | 130 | 45 | 15 | 430 | 0 | 0 | L |
| 129 | 60 | 45 | 0 | 10 | 0 | 25 | 0 | 0 | L |
| 151 | 55 | 245 | 140 | 30 | 70 | 435 | 1 | 1 | L |
| 152 | 0 | 0 | 0 | 10 | 0 | 15 | 0 | 0 | L |
| 153 | 30 | 155 | 90 | 5 | 30 | 270 | 0 | 0 | L |
| 154 | 40 | 175 | 155 | 20 | 35 | 270 | 1 | 2 | M |
| 155 | 85 | 210 | 155 | 45 | 60 | 295 | 2 | 2 | M |
| 156 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | L |
| 157 | 90 | 195 | 100 | 55 | 65 | 355 | 0 | 0 | L |
| 158 | 95 | 250 | 65 | 20 | 35 | 435 | 1 | 1 | M |
| 159 | 40 | 350 | 190 | 20 | 55 | 630 | 3 | 2 | M |
| 160 | 105 | 320 | 215 | 20 | 55 | 595 | 0 | 0 | L |
| 161 | 25 | 340 | 355 | 0 | 30 | 630 | 0 | 0 | L |
| 162 | 50 | 300 | 315 | 5 | 45 | 470 | 0 | 0 | L |
| 163 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | L |
| 164 | 55 | 255 | 225 | 5 | 40 | 330 | 0 | 0 | L |
| 165 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | L |
| 166 | 45 | 325 | 325 | 25 | 20 | 500 | 2 | 2 | M |
| 167 | 40 | 275 | 60 | 10 | 50 | 495 | 1 | 1 | M |
| 168 | 50 | 305 | 330 | 15 | 60 | 525 | 1 | 1 | M |
| 169 | 25 | 275 | 250 | 10 | 35 | 425 | 0 | 0 | L |
| 170 | 25 | 190 | 185 | 0 | 25 | 350 | 0 | 0 | L |
| 175 | 130 | 210 | 50 | 10 | 20 | 545 | 0 | 0 | L |

# DESIGNATION OF INCIDENCE OF SCHIZOPHRENIA: WINDSOR




SOURCE: ST. THOMAS ADMISSION RECORDS, 1976 CENSUS, ENUMERATION AREAS

FIGURE 5-MAP 1

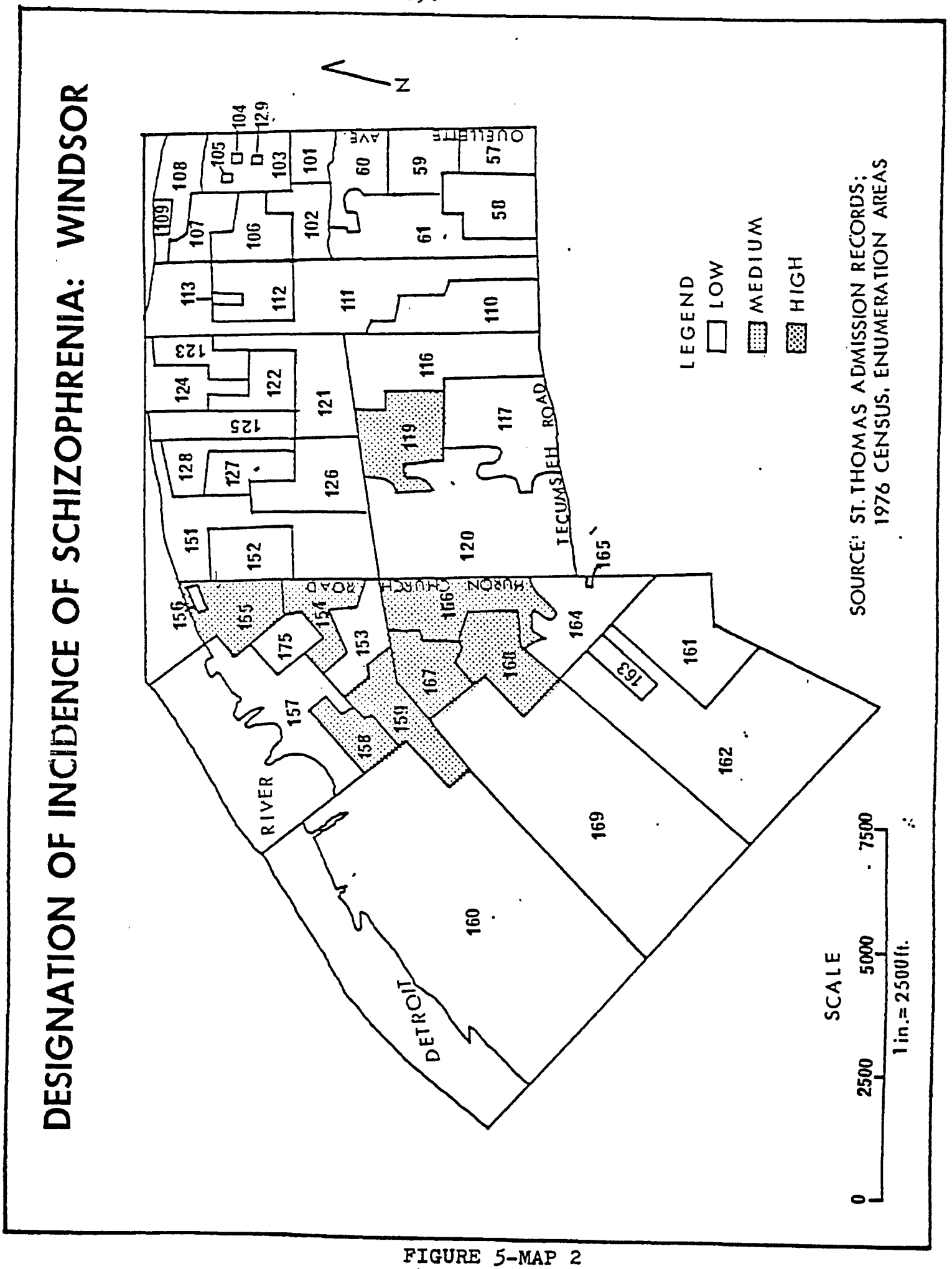



FIGURE 5-MAP 2

# DESIGNATION OF INCIDENCE OF SCHIZOPHRENIA:

## WINDSOR

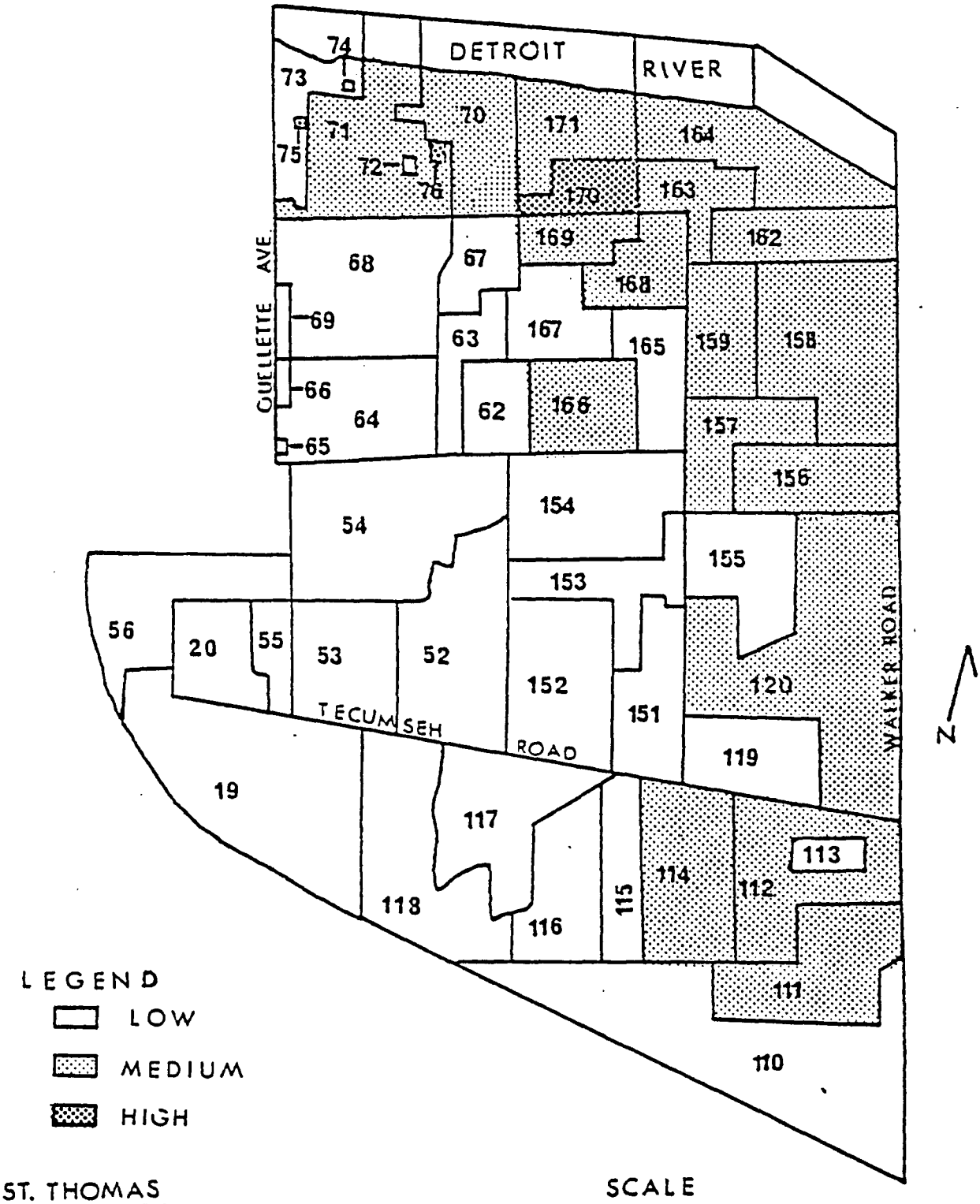



FIGURE 5-MAP 3

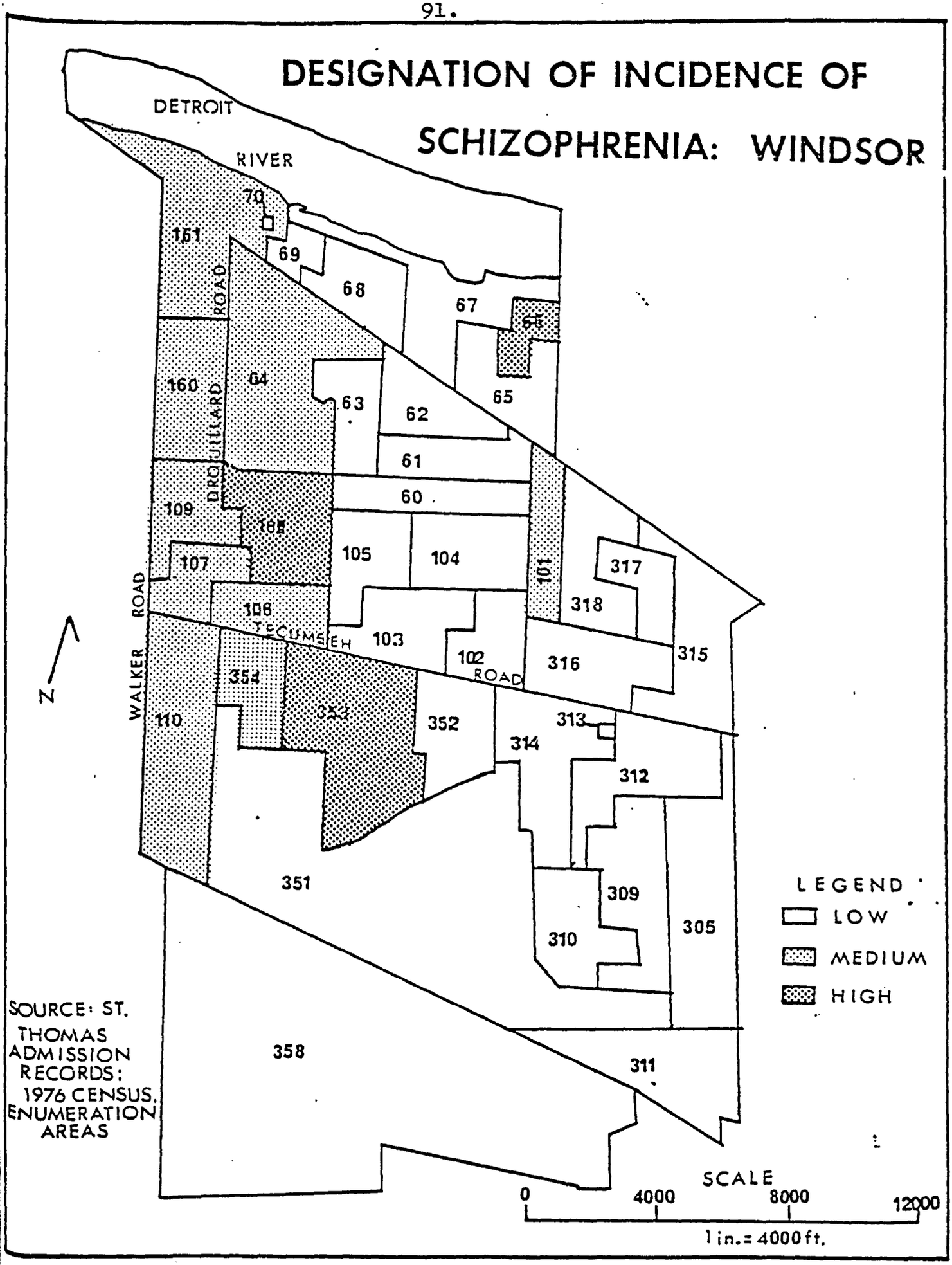



FIGURE 5-MAP 4

# DESIGNATION OF INCIDENCE OF SCHIZOPHRENIA: WINDSOR

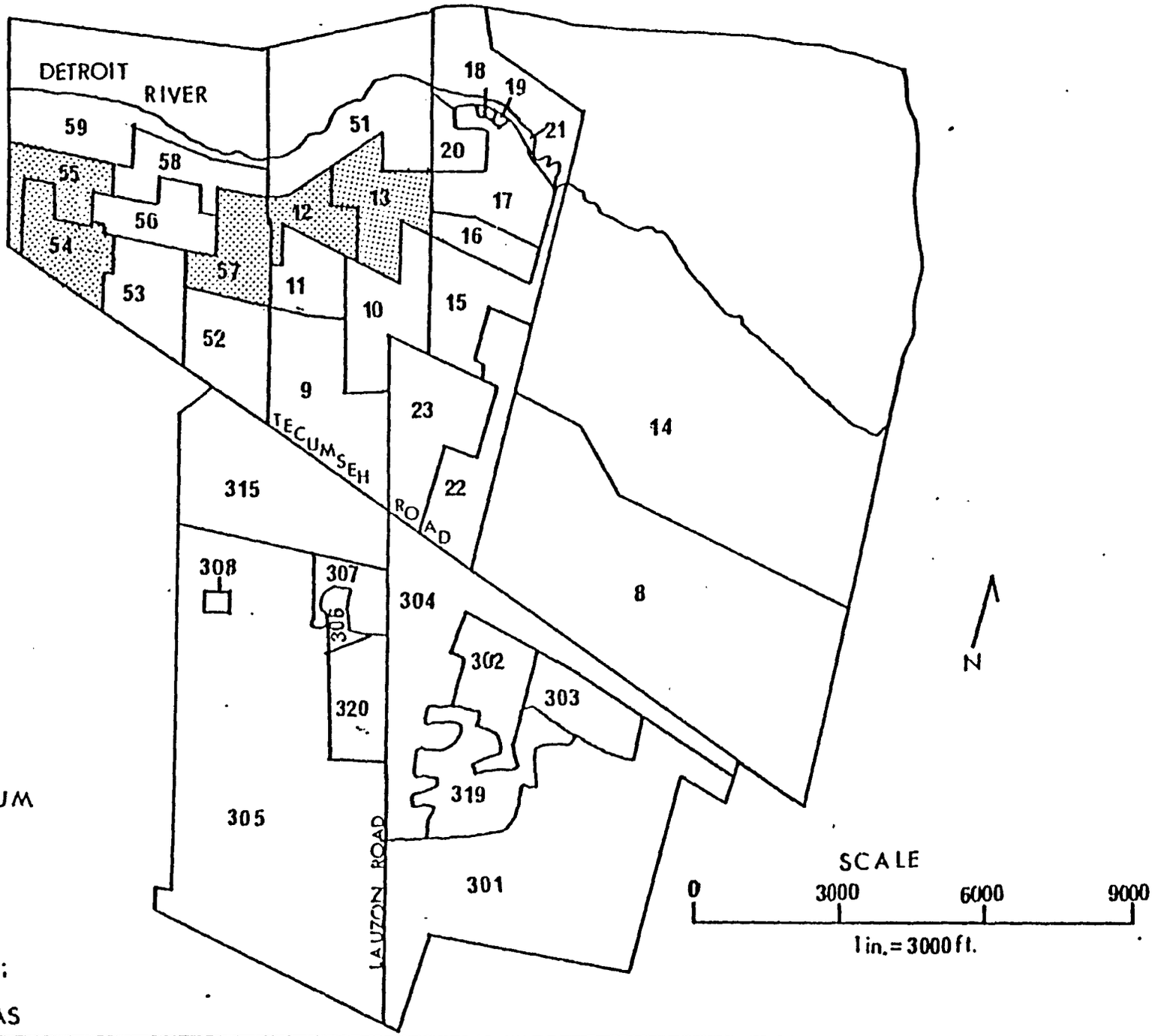



FIGURE 5-MAP 5

In the analysis Variable 2, Number of persons per household, 2-10 was first entered into the analysis. On the printout the $F_{observed}$ and the degrees of freedom were provided in order to allow an F-test of significance. This F-test was shown in Table 9. Variable 6, Age (15-44) was the second variable entered into the analysis. With the $F_{observed}$ and the degrees of freedom provided an F-test was undertaken to test for significance. This was shown on Table 10.

Both of these variables, Number of persons per household (2-10), and Age (15-44) proved to be significant in terms of being indicators of the schizophrenia pattern in Windsor. This indicated that areas with a high percentage of households with more than one person and with a high percentage of people falling in the age range 15-44 prossessed higher incidences of schizophrenia for the City of Windsor. The results for the age variable supported the ideas expressed in the literature. The age range of 15-44 was indicated as the age range with the highest incidence of schizophrenia and this was supported by the age variable used in the Discrimenant Analysis for Windsor. On the other hand, the results for the household size variable of 2-10 persons proved to be contradictory to that which was professed in the literature.

TABLE 9

F-TEST OF SIGNIFICANCE OF VARIABLE 2-NUMBER OF PERSONS PER HOUSEHOLD (2-10) AS INDICATOR OF PATTERN OF SCHIZOPHRENIA CASES IN WINDSOR

This was to test whether or not the variable, Number of Persons per Household (2-10), was significant with respect to the pattern of schizophrenia cases in Windsor.

Degrees of Freedom: 2 and 207

$F_{critical} = 3.00$

$F_{observed} = 4.701$

Since $F_{observed}$ exceeded $F_{critical}$ the null hypothesis ($H_0$) was rejected and the variable, Number of Persons per Household (2-10), was inferred to be significant in indicating the schizophrenia pattern in Windsor.

Note:

$H_0$: The variable, Number of Persons per Household (2-10) was not significant in indicating the schizophrenia pattern in Windsor.

$H_a$: The variable, Number of Persons per Household (2-10) was significant in indicating the schizophrenia pattern in Windsor.

Significance Level: .05 SOURCE: Renaud, 1981

TABLE 10

F-TEST OF SIGNIFICANCE OF VARIABLE 6-AGE (15-44) AS INDICATOR OF PATTERN OF SCHIZOPHRENIA CASES IN WINDSOR

This was to test whether or not the variable, Age (15-44), was significant in indicating the schizophrenia pattern in Windsor.

Degrees of Freedom: 4 and 412

$F_{critical} = 2.37$

$F_{observed} = 4.529$

Since $F_{observed}$ exceeded $F_{critical}$ the null hypothesis ($H_0$) was rejected and the variable, Age (15-44) was inferred to be significant in indicating the schizophrenia pattern in Windsor.

Note:

$H_0$: The variable, Age (15-44) was not significant in indicating the schizophrenia pattern in Windsor.

$H_a$: The variable, Age (15-44) was significant in indicating the schizophrenia pattern in Windsor.

Significance Level: .05

SOURCE: Renaud, 1981

In the literature a household size of one was supposed to lead to higher incidences of schizophrenia, but for Windsor case it seemed that the pressures of more than one person in a household seem to produce higher schizophrenia incidences. This contradiction with the literature should be further investigated by conducting reaearch of the same type in other cities.

The Step-Wise Discriminant Analysis did not provide a perfect classification of the enumeration areas on the basis of the six variables or indicators used in this study. On the basis of these indicators, only 37.5 percent of the enumeration areas classified as low were classified correctly, 54.5 percent of the medium concentration areas were classified correctly while 83.3 percent of the high concentration enumeration areas were classified correctly. The breakdown of the classification should have been more like 76 enumeration areas classified with low concentrations, 88 enumeration areas classified with medium concentrations, and 46 enumeration areas classified with high concentrations. This incorrectness in classification might have resulted from the manner in which the enumeration areas were grouped. The first run through of the Discriminant Analysis

grouped the enumeration areas on the basis of frequency of cases in each. This method produced a classification more incorrect than the one produced in the second run through along with no significant variables. Therefore maybe a number of regroupings of the enumeration areas might have been used but this was not feasible in this study. Also the incorrectness of the classification might have resulted from the poor performance of the six variables chosen in indicating the schizophrenia pattern in Windsor. Only two of the six variables proved to be significant.

Figure 6 illustrated a copy of the canonical correlation plot provided by the computer output. This Figure indicated that the pattern of low, medium and high concentrations were scattered with a clustering of low and medium concentrations or incidences in the central part of the area. Areas of low concentration were clustered in the centre and scattered on the periphery of the plot. Medium concentration areas were generally clustered in the centre, while high concentration areas were scattered on the bottom periphery of the plotted pattern.

As a result, of the Step-Wise Discriminant Analysis, Variables 2 and 6, household size of 2-10 persons and age of 15-44 have been justified as being able to discriminate between areas of low, medium and high concentrations of schizophrenia incidence. The problems, which arose in the analysis, might be overcome by extending the analysis by running several Step-Wise Discriminant Analyses.

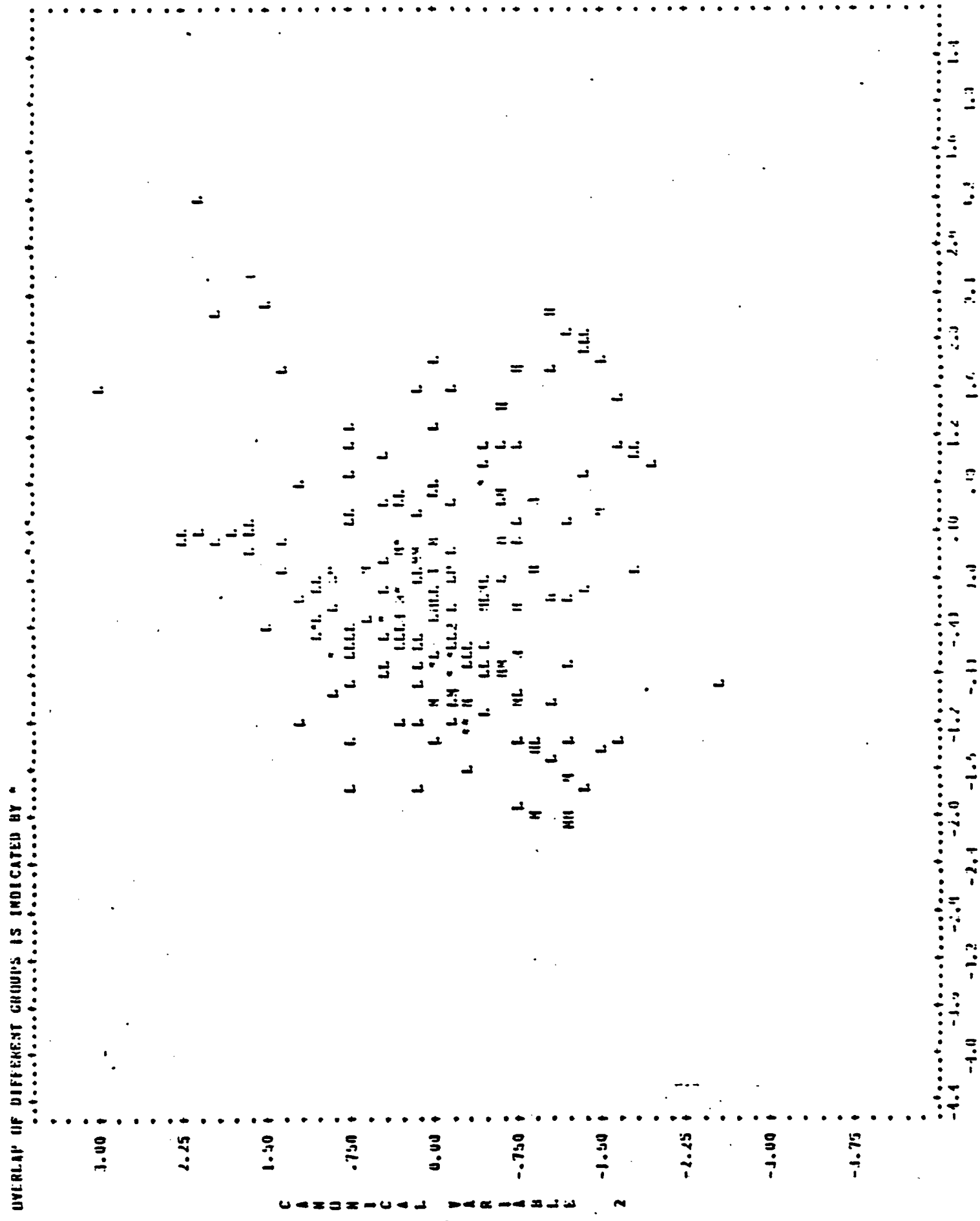
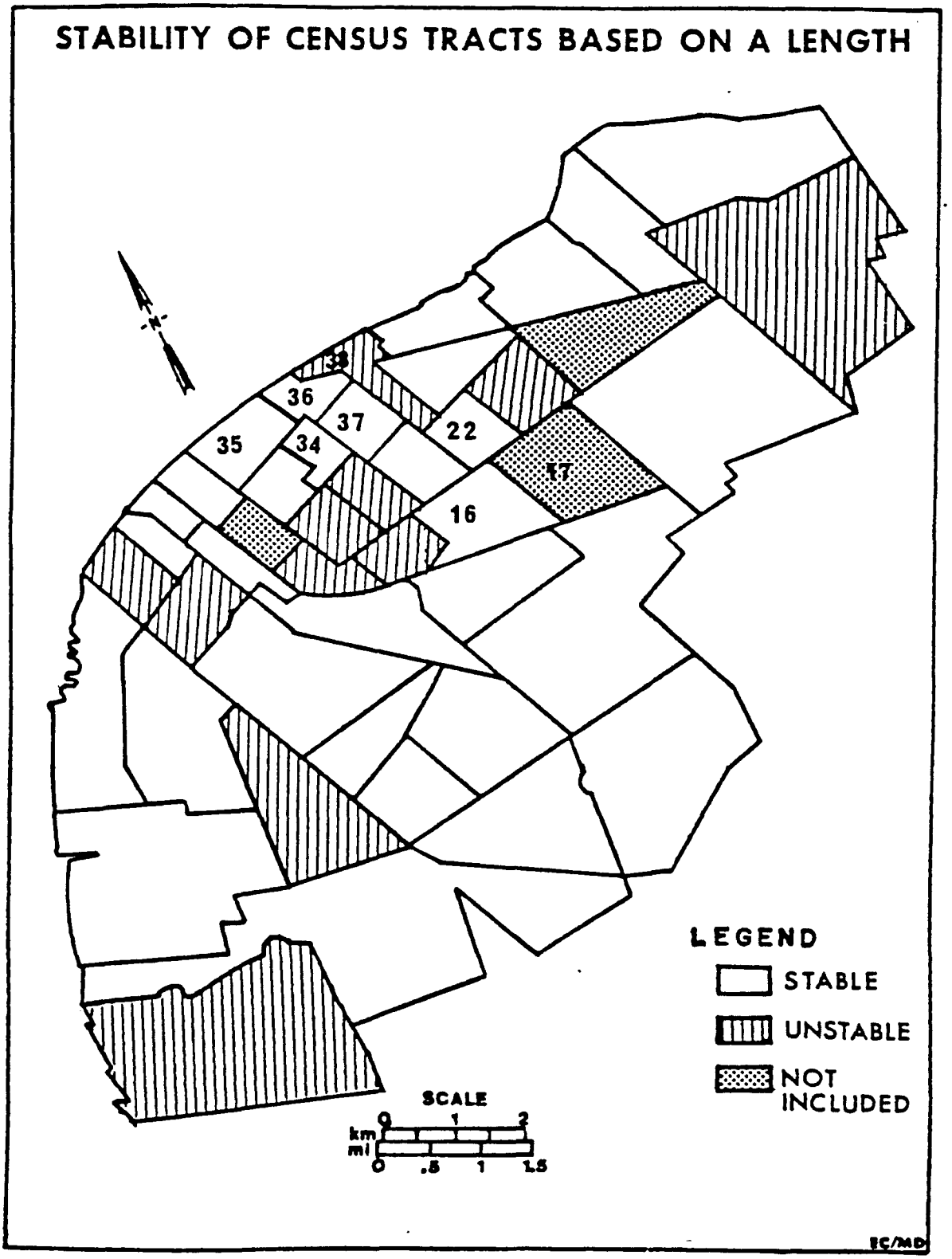



FIGURE 6

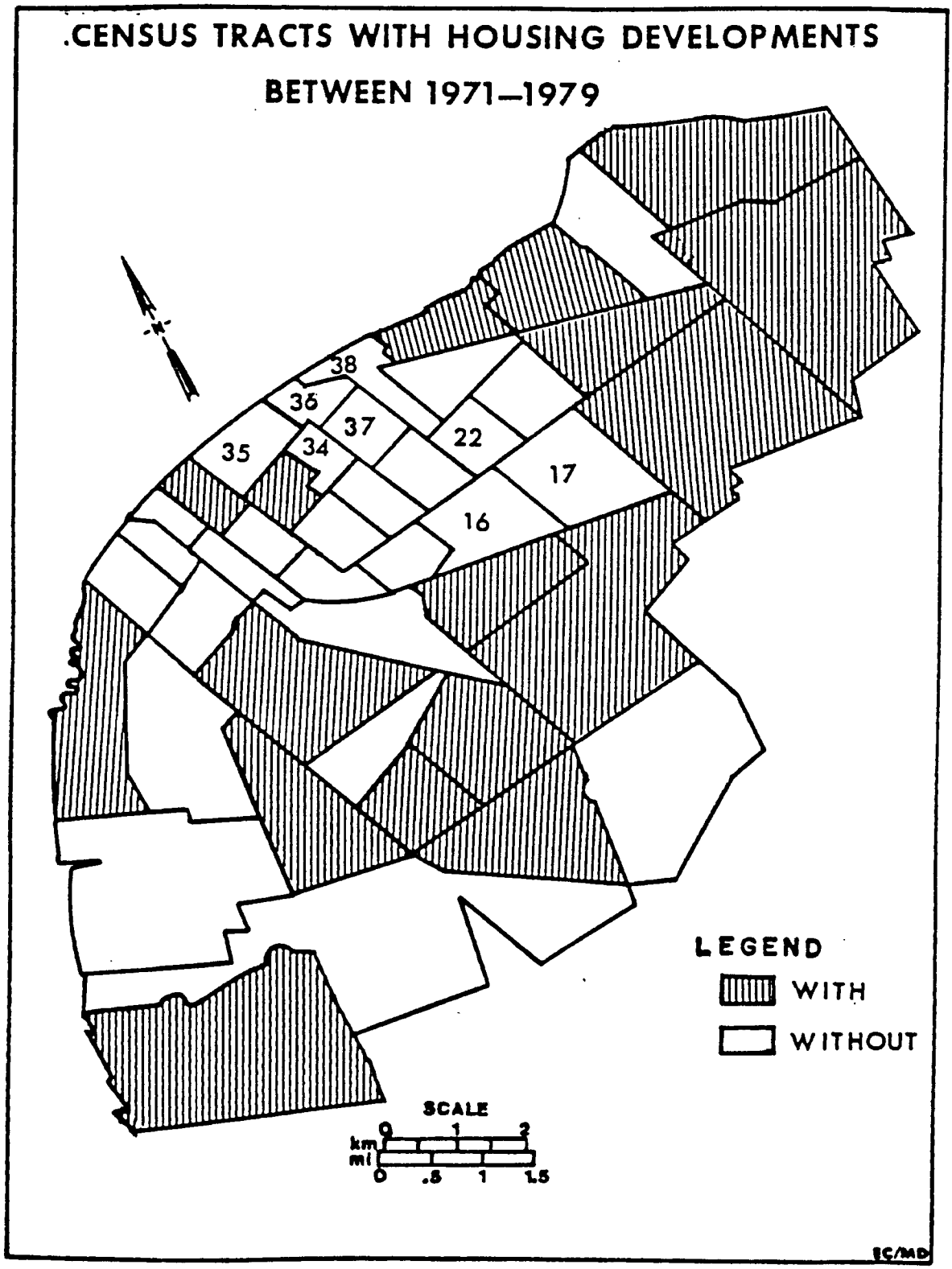
The final step in the analysis was to try to determine characteristics of the enumeration areas where the schizophrenia cases were clustered. The major cluster was found on map three between Howard Avenue, Walker Road, Riverside Drive and Giles Blvd. A secondary cluster was found on map four to the southeast of the first cluster between Walker Road, Central Avenue, Grand Marais Avenue and Seminole Street.

Renaud(1980) investigated the stability of the census tracts in Windsor on the basis of length of residence. The stability of the census tracts was based on a length of residence of six years or more. The cluster of schizophrenia cases on map three was in enumeration areas 170, 171, 163, 164, 169, 168, 162, 159, 158, 157 and 156. This cluster of enumeration areas corresponded to census tracts 36, 37, 35 (eastern section) and 34 on the census tract map showing the stability of the census tracts (Figure 7). These census tracts were designated as stable on the basis of a length of residence of six years or more. Therfore this cluster was characterized by low mobility. The secondary cluster of schizophrenia cases on map four was found in enumeration areas 160, 61, 109, 108, 107, 106, 110, 354 and 353. This cluster of enumeration areas corresponded to census tracts 38 (southern section), 22, 16 and 17. Census tract 38 was designated as unstable, 17 was not included, 16 and 22 were designated as stable. This cluster was also basically characterized by low mobility with the exception of the southern section of census tract 38, which was characterized by high mobility.




SOURCE— RAW DATA FROM, QUESTIONNAIRE, GEOGRAPHY DEPT., U. OF WINDSOR, 1978.

FIGURE 7




SOURCE: METRO WINDSOR DEVELOPMENT MAP, CITY OF WINDSOR

FIGURE 8

Another variable investigated by Renaud (1980) was housing developments in the census tracts between 1971 and 1979. Both the major and secondary cluster of schizophrenia cases corresponded to census tracts without any housing developments between 1971 and 1979. This was illustrated by Figure 8. This might indicate that these areas of schizophrenia clustering were characterized by older housing and possibly poorer economies since housing developments were not started in these areas for almost a decade.

Oliver (1977) identified poverty pockets in a study of Windsor. She used 1971 census data and found that census tracts 31, 32, 33, 35, 38 and 12 were poverty pockets of Windsor. Census tracts 35 (eastern section) and 38 (southern section) were two of the poverty pockets which coincided with the two schizophrenia clusters found in Windsor. Census tract 38 was characterized by a deteriorating rundown housing stock and its major problems seemed to be associated with the proximity of heavy industry. However, since Oliver used 1971 census data these conditions might have changed.

The preceding analysis indicated that hypothesis number one should be rejected for the Windsor case. Hypothesis number two was accepted for the Windsor case. Two variables in hypothesis number three were justified as good discriminators of the schizophrenia pattern in Windsor; size of household, 2-10 and age, 15-44. Hopefully, this analysis has provided a basic conception and understanding of the distribution of schizophrenia cases in Windsor.

# CHAPTER VIII

## CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER STUDY

This study was done on the basis of data provided from the admission records of St. Thomas Provincial Mental Hospital. The data possessed its limitations in terms of sample size and diagnosis bias. As a result, this data was not as statistically reliable as it could have been. This might mean that the results cannot be stated as strongly as one would wish. Otherwise, the study was a success and might prove to be useful in the future.

An indication of a few of the variables that discriminated between areas of low and high schizophrenia incidences was given. However, this study might have been improved if 1976 census data was available at enumeration area levels for more variables such as income and occupation. This would have provided more information on the characteristics of the enumeration areas where the schizophrenia caes were clustered.

It would be academically challenging to undertake a comparative analysis of schizophrenia patterns for two Ontario cities whose economies were based on different sectors of the economy such as a manufacturing community versus a community based on retail and services. This would furnish another step toward creating a more precise profile of the development of schizophrenia. This thesis was designed to act as a springboard for future studies of schizophrenia and other mental disorders in the

field of Medical Geography.

Further improvements to the study would be realized if the time frame was enlarged. A greater sample size might have resulted in reinforcing findings and repetitive patterns of patient origin might have been discovered. As it is, a clustering of origins is observed as significant thus leaving open the possibility that schizophrenia stimuli might yet be found to relate to specific socio-economic environmental factors. Just what these factors might be still eludes us but some aspects of this study might subsequently be found to point in the right direction.

# BIBLIOGRAPHY


Allodi, F., 1978: The Utilization of Mental Health Services by Immigrant Canadians. Canada's Mental Health, Vol. 26, No. 2, Toronto, pp. 7-10.

Armstrong, A.W., 1972: Computers and Mapping in Medical Geography. Medical Geography: Techniques and Field Studies, Methuen and Co. Ltd., pp. 69-84.

Bain, Robert, 1972: The Spatial Variation of Voting Behaviour in the 1968 Federal Election in Toronto as it Relates to the Spatial Distribution of Selected Socio-Economic Parameters. An unpublished thesis, University of Windsor, 163 p.

Baldwin, J.A., (ed.), 1971: Aspects of the Epidemiology of Mental Illness. International Psychiatry Clinics, Vol. 8, No. 3, Little Brown and Co., Boston, 223 p.

Barrett, Frank A., 1980: Canadian Studies in Medical Geography. Geographical Monographs, No. 8, York University, 263 p.

Calhoun, James F., 1977: Abnormal Psychology, Current Perspectives. Random House, New York, pp. 273-327.

Cartwright, F.F., 1972: Disease and History. Crowell Co., New York, 198 p.

Casetti, Emilio, 1964: Classification and Regional Analysis by Discriminant Iteration. Thesis, Northwestern University.

Census of Canada, 1976: Population and Housing Statistics for Windsor, Ottawa.

Choynowski, M., 1959: Maps based on probabilities. American Statistical Association Journal, Vol. 54, pp. 385-388.

Christou, E.N., 1978: Spatial Variations of Ischaemic Heart Disease Mortalities in Windsor, Ontario 1967-1975. An unpublished thesis, University of Windsor, 79 p.

Desmarais, M.A., 1977: The Spatial Variations of Bronchogenic Lung Cancer in Windsor 1970-1977. An unpublished thesis, University of Windsor, 59 p.

Desmarais, M.A., 1981: Lifestyle Variables in Relation to Disease Patterns: A Statistical Analysis of the Windsor Data. An unpublished thesis, University of Windsor, 141 p.

Dixon, W.J. and Brown, M.B., (eds.), 1977: Biomedical Computer Programs, P-series. University of California Press, Berkeley, pp. 711-733.

Dunham, Warren, 1965: Community and Schizophrenia: An Epidemiological Analysis. Wayne State University Press, Detroit, pp. 108-256.

Eisenbeis, Robert A. and Avery Robert B., 1972: Discriminant Analysis and Classification Procedures, Theory and Applications. D.C. Heath and Company, Lexington, Mass., 245 p.

Faris, Robert and Dunham, Warren, 1967: Mental Disorders in Urban Areas. The University of Chicago Press, Chicago, 177 p.

Haggett, P., 1976: Hybridizing Alternative Models of an Epidemic Diffusion Process. Economic Geography, Vol. 52, pp. 136-146.

Hammond, R. and McCullagh, P., 1974: Quantitative Techniques in Geography. Claredon Press, Oxford, pp. 237-249.

Hollingshead, August B. and Redleich, 1958: Social Class and Mental Illness: A Community Study. John Wiley and Sons, New York, 407 p.

Howe, G.M., 1970: A National Atlas of Disease Mortality in the United Kingdom. Nelson Co., London, 197 p.

Howe, G.M., 1972: Man, Environment and Disease in Britain: A Medical Geography of Britain Through the Ages. Barnes and Noble Books, New York, 285 p.

Howe, G.M. and Loraine, J.A., 1976: Environmental Medicine. Heinemann Medical Books Ltd., London, pp. 25-51.

Hunter, J.M. and Brunn, S.D., 1974: The Geography of Psycosocial Stress. The Geography of Health and Disease, University of North Carolina, Chapel Hill, pp. 128-153.

Hunter, N.K. and Young, J.C., 1971: Diffusion of Influenza in England and Wales. Annals of American Association of Geographers, Vol.61, pp. 637-653.

Khan, R., 1971: The Purpose, Scope and Progress of Medical Geography. Indian Geography Journal. Vol. 46, pp. 1-9.

Kleiner, R.J., 1959: Migration and Mental Illness: A New Look. American Sociological Review. Vol. 24, pp. 301-325.

Lader, Malcolm, 1975: The Psychophysiology of Mental Illness. Routledge and Keagan, Paul, Boston, 262 p.

LeRiche, W.H. and Milner, J., 1971: Epidemiology of Medical Geography. Longman Group Ltd., London, 448 p.

Levy, Leo and Rowitz, Louis, 1973: The Ecology of Mental Disorders. Behavioural Publications, New York, pp. 3-22.

May, J.M., 1958: Studies in Medical Geography. M.D. Publications Inc., 327 p.

May, J.M., 1974: The Geography of Nutrition. The Geography of Health and Disease, University of North Carolina, Chapel Hill, 193 p.

Malzberg, Benjamin, 1963: Mental Disease in Canada, 1950-1952, Among Italian-Born. Research Foundation for Mental Hygiene, Inc., 40 p.

Malzberg, Benjamin, 1963: Mental Disease Among Jews in Canada, 1950-1952. Research Foundation for Mental Hygiene, Inc., New York, 86 p.

Malzberg, Benjamin, 1963: Mental Disease in Canada, 1950-1952, Among Those Born in the United States. Research Foundation for Mental Hygiene, Inc., New York, 48 p.

Malzberg, Bejamin, 1963: Mental Disease in Canada, 1950-1952, Among Those Born in the United Kingdom. Research Foundation for Mental Hygiene, Inc., New York, 42 p.

Malzberg, Benjamin, 1963: Mental Disease Among Native and Foreign-Born in Canada, 1950-1952. Research Foundation for Mental Hygiene, Inc., 37 p.

Malzberg, Benjamin, 1964: Internal Migration and Mental Disease in Canada, 1950-1952. Research Foundation for Mental Hygiene, Inc., New York, 111 p.

Malzberg, Benjamin, 1964: Mental Disease in Canada, 1950-1952. Research Foundation for Mental Hygiene, Inc., New York, 79 p.

Martin, L.E., 1970: Mental Health/Mental Illness: Revolution in Progress. McGraw-Hill Book Co., Toronto, 164 p.

McConnell, H., 1968: Spatial Analysis in Geomorphology. (ed. R.J. Chorley), Methuen, London.

McGlashan, N.D., 1969: The Scope of Medical Geography. South African Medical Journal, Vol. 47, pp. 362-368.

McGlashan, N.D., 1969: The Nature of Medical Geography. Pacific Viewpoint, Vol. 10, pp. 60-64.

McGlashan, N.D., 1972: European Male Stomach Cancer in South Africa: A Cartographic Appraisal. Medical Geography: Techniques and Field Studies, Methuen and Co., Ltd., London, 336 p.

Mears, F. and Catchel, R.J., 1979: Fundamentals of Abnormal Psychology. Rand McNally College Publishing Co., Chicago, pp. 190-217.

Mednick, Sarnoff A., et al., (eds.), 1974: Genetics, Environment and Psychopathology. North-Holland Publishing Co., New York, 322 p.

Milt, Harry, 1974: Basic Handbook on Mental Illness. Charles Scribner's Sons, New York, pp. 36-50.

Morgan, Peter and Andrushko, Elizabeth, 1977: The Use of Diagnosis-Specific Rates of Mental Hospitalization to Estimate Under-utilization by Immigrants. Social Science and Medicine, Vol. 11, Britain, pp. 677-684.

Murphy, H.B.M., 1977: Migration, Culture and Mental Health. Psychological Medicine, Vol. 7, Britain, pp. 677-684.

Myers and Bean, 1968: A Decade Later: A Follow Up of Social Class and Mental Illness. John Wiley and Sons, New York.

Oliver, L.H.T., 1977: The Identification of Poverty Pockets in the City of Windsor: 1971. An unpublished thesis, University of Windsor, 162 p.

Orley, J.H., 1970: Culture and Mental Illness. East African Studies, No. 36, East African Publishing House, 80 p.

Parker, S. et al., 1969: Migration and Mental Illness: Some Reconsiderations and Suggestions for Further Analysis. Social Science and Medicine, Vol. 3, pp. 1-9.

Plunkett, R.J. and Gordon, J.E., 1960: Epidemiology and Mental Illness. Basic Books, Inc., New York, 106 p.

Primrose, E.J.R., 1962: Psychological Illness, A Community Study. Tavistock Publications, 53 p.

Pyle, Gerald F., 1979: Applied Medical Geography. John Wiley and Sons, Toronto, pp. 3-31.

Rajsigl, Duane, 1981: The Spatial Variations of Infant Mortality in the City of Windsor. An unpublished thesis, University of Windsor, 114 p.

Renaud, J.A., 1980: An Investigation Into The Residential Stability of Windsor. An unpublished thesis, University of Windsor, 79 p.

Rose, Arnold M., (ed.), 1955: Mental Health and Mental Disorders: A Sociological Approach. W.W. Norton and Co., Inc., New York, 612 p.

Sauer, H.I.and Enterline, P.E., 1959: Are Geographic Variations in Death Rates for Cardiovascular Diseases Real? Journal of Chronic Diseases, Vol. 10, pp. 513-524.

Sauer, H.I., 1962: Epidemiology of Cardiovascular Mortality: Geographic and Ethnic. Journal of Public Health, Vol. 52, pp. 94-105.

Scheff, Thomas J., 1966: Being Mentally Ill, A Sociological Theory. Aldine publishing Co., Chicago, 201 p.

Scheff, Thomas J., (ed.), 1967: Mental Illness and Social Processes. Harper and Row, New York, 294 p.

Silk, John, 1979: Statistical Concepts in Geography. George Allen and Unwin, Boston, pp. 95-130.

Spence, J.T. et al., 1968: Elementary Statistics. Appleton-Century-Crofts, New York, 241 p.

Tusling, W.G., 1971: Analyzing The Pattern of Discrete Spatial Distributions: Selected Topics in Quadrat Analysis. University of Bloomington Indiana, 27 p.

Statistics Canada, 1974-1980: Mental Health Statics. Vol. 1, Ministry of Industry, Trade and Commerce, Ottawa.

Taylor, P.J., 1977: Quantitative Methods in Geography. Houghton Mifflin Co., Boston, pp. 133-172.

Thomas, R.W., 1977: An Introduction To Quadrat Analysis. Geo Abstracts Ltd., University of East Anglia, Norwich, 37 p.

Van de Geer, J.P., 1971: Introduction to Multivariate Analysis for the Social Sciences. W.H. freeman and Co., San Francisco, California.

Wallis, W.A. and Roberts, H.V., 1975: Statistics: A New Approach. The Free Press, Glencoe, Illinois, 619 p.

Williamson, E. and Bretherton, 1963: The Tables of the Negative Binomial Probability Distribution. John Wiley and Sons Ltd., New York.

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